PELICAN BOOKS

SCIENTIST IN RUSSIA

by Eric Ashby

(A 186)

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TO

THE MEMBERS OF THE

BOTANY SCHOOL TEA CLUB

UNIVERSITY OF

SYDNEY

FOREWORD

In 1944 the Australian Government, on the initiative of the Minister for External Affairs, decided to send a scientist for a year to the Australian Legation at Moscow. It was my good fortune to be selected for this mission. In addition to technical information, which was sent to my Government in official despatches, I collected a good deal of other information of interest to scientists. Accordingly I have written this unofficial account, which contains material which I am not obliged to embalm in mimeographed reports.

It is a pleasure to acknowledge help from several sources. First of all I thank the Hon. H. V. Evatt, Deputy Prime Minister and Minister for External Affairs, for carrying out the experiment of sending a scientist to Russia; and I thank the Hon. J. J. Maloney, former Australian Minister to Moscow, for allowing me to do what I liked there. I am grateful to the Joint Press Reading Service in Moscow, whose press summaries saved me a great deal of time, to Dr. George Bolsover for some data on education which are incorporated in Chapter 3, and to Mr. R. Windeyer, who read the typescript and improved it in many ways. I remember with pleasure my Russian acquaintances in fifty-odd institutes, who patiently explained their work to me. I thank Miss G. Carey, who drew the diagrams for Chapter 5, and Miss D. Grice, who patiently typed her way through my untidy manuscript. Finally I thank my colleagues in the Botany School of the University of Sydney, who did my proper job for me while I was away in Russia; to them I dedicate this book.

The University,
Sydney,
Australia.
July, 1946.

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INTRODUCTION

'WE are immoderate, we are an astonishing blend of good and evil; we love enlightenment . . . and at the same time we riot in taverns . . . we are broad natures . . . able to accommodate every possible contradiction . . . we are broad like Mother Russia herself; we find room for everything, we reconcile ourselves to everything.'

It is the prosecutor Kirillovich speaking in *The Brothers Karamazov*. His words are a fit opening for a book about Russia; for the trouble about many books on Russia is that they aim at being consistent, and the more consistent they are the less accurate they are likely to be. The Russian people are notoriously inconsistent. They are 'able to accommodate every possible contradiction'. And what is true of the Russian people is no less true of their science.

This book records a scientist's observations and impressions of science in Russia during 1945. It would be possible to write a book about science in England without more than passing reference to the philosophy of Englishmen, or to their social life, or to the atmosphere of England. But a book about science in Russia has to have more than facts and figures. Tens of thousands of Soviet scientists are at work in thousands of research institutes; and it is impossible to estimate accurately their motives and their accomplishments without some knowledge of their social and political background. Accordingly this book contains matter of two sorts: information on the organisation of science and of education in the Soviet Union, and studies of the social customs, philosophical beliefs, and official propaganda, which are the context of Soviet science. It does not try to present a story without contradictions, because the story is in fact contradictory.

There was a period in the history of the Soviet Union

when foreigners could visit Russia easily. They were at liberty to travel, to talk freely to Soviet citizens and even to visit their homes. But since the purges began in 1936 the official attitude to foreigners has stiffened, and today the Soviet Union is virtually closed to the casual traveller. Broadly speaking, a foreigner can visit Russia today only in one or other of three ways: as a guest of the Soviet Government, as a diplomatist, or as a member of the press corps. Guests of the Soviet Government are brought to Russia on brief and feverish visits. They are entertained with Oriental ostentation. They are overworked, overfed, and over-stimulated, and all but the most critical of them go home staggered by Soviet hospitality and astonished with what has been shown them. Members of the diplomatic corps and the press corps are the only foreigners who can stay long enough in Russia to become familiar with the Soviet way of life; but they receive very different treatment. They may mix freely with one another (and it is well to remember that even this was not allowed to diplomatists in Russia in the seventeenth century); they may attend State receptions, the opera, and the ballet; but they are deliberately sealed off from Soviet life and institutions. They cannot themselves arrange to visit a factory or a school or a farm. They rarely meet a Russian who has not had official permission to mingle with foreigners. In the light of these circumstances it is not surprising that so much writing about Russia falls into one or other of two categories: monotonous panegyrics from visitors who have been led round Moscow like sacred bulls in an Oriental city; and petulant denunciations from pressmen who have been confined to the Metropol hotel.

An observer who is sent by his Government to study the organisation of science in the U.S.S.R. has to accept at the outset a major inconsistency in the Russian attitude to foreigners: on the one hand the sincere friendliness of the people, and on the other hand the deliberate suspicion of the State. The foreign observer must be attached to the

diplomatic corps, otherwise he would not get a visa to stay long enough in the country. Once inside Russia he finds that his diplomatic status imprisons him in the regulations of protocol. In the eyes of Soviet citizens he is unclean. No Russian, except the appropriate officials, will ever visit him. He will not be invited openly to Russian homes. He cannot even take an ordinary Soviet citizen to a concert or for a walk in the park. None of this fantastic ostracism comes from the Russian people themselves. It is entirely due to fear on their part of State disapproval. It is no exaggeration to say that during my stay in Russia I received nothing but kindness, openness, and co-operation from Soviet scientists, agriculturists, and the officials of industrial enterprises; there was not one instance of hostility or suspicion. Also it is no exaggeration to say that from the government department charged with the duty of maintaining 'cultural contacts' with foreigners, I received very little beside obstruction, inefficiency, and evasion. Through the co-operation of the Soviet Foreign Office, the President of the Academy of Sciences, and two Vice-Commissars, I was able in the end to learn something about science in Russia, and I came away with an admiration for some Russian accomplishments and a sympathetic understanding of some Russian problems. But had I relied upon the activities of the Society for Cultural Relations with Foreign Countries (VOKS) I should have come home, as so many other foreigners have come home, frustrated and disgruntled.

Any foreigner in Moscow who wishes to see something of Soviet life and institutions is referred to VOKS. Visits to universities, schools, scientific institutions, farms: all these have to be arranged through VOKS. Members of the diplomatic and press corps are unanimous in their exasperation with VOKS, and it is despised by the Russians themselves. For the serious student, who comes to Russia for more than a month, and who wants more information than is contained in the official 'hand-outs', VOKS is a major

obstacle to cultural and scientific relations, and what is still more serious, VOKS grossly damages Russian prestige abroad.

One or two things VOKS does well. It acts as hostess to distinguished official guests of the U.S.S.R. The official guest is met at the airfield by VOKS. He has a charming and efficient young lady, who speaks excellent English, attached to him for all his waking hours. By day VOKS conducts him around crêches, museums, and hospitals. By night VOKS takes him to the ballet, the theatre, the opera. VOKS sees that there are wine and cigarettes in his room at the hotel, and gives him a couple of thousand roubles to spend in the shops. And if the visitor is very distinguished, VOKS takes him to Tashkent, to Kiev, to Leningrad. It may even arrange for his portrait to be painted. Occasionally VOKS arranges concerts or readings in honour of foreigners. The intelligentsia of Moscow and the diplomatic corps are invited to an evening of English songs, or a recital by Menuhin, or a reading of Priestley. Then the foreigner may meet Prokofiev and chat with Ilya Ehrenburg, over wine and rich cream cakes, during the interval. Finally VOKS produces an immense amount of information in foreign languages and sends it all over the world. The Friends of the Soviet Union in London and New York, the Russian–Australian Society in Melbourne and Sydney—people of goodwill toward Russia—draw from this perpetually flowing conduit of slick propaganda. VOKS excels in these somewhat flippant occupations. But as a window through which the foreigner can see into Russia it has two serious drawbacks: it is rose-coloured; and it is frosted.

Either because it does not possess the proper facilities, or because it is acting under instructions from above, VOKS is of little help to the long-term visitor to Russia who wishes to gain a scholarly understanding of some aspect of Soviet society. The long-term visitor, having been specifically instructed by the Soviet Government to make

all his cultural contacts only through VOKS, applies (to give a random example) to be allowed to meet a professor in the university. Here is a record from my diary of the experience he may expect:— .

> *Visit to Professor X at the University.* Applied to VOKS, March 3rd. Renewed application March 9th and March 20th. Told the professor was busy but would probably be able to give an interview soon. Renewed application April 4th, 6th, 14th, 21st, 27th, and May 13th and 17th. No result. In June, made contact direct with the Committee for Higher Education, and explained failure of VOKS to arrange interview; saw the professor officially five days later, and found he had not been approached by VOKS at all, and was delighted to have an interview.

It is experiences like this one which discourage the diplomatists and pressmen in Moscow. But this initial period of frustration is inevitable. It should not embitter the serious student, for it is not all due to deliberate obstruction; it is partly due to the easy-goingness of the Russian character, somewhat reminiscent of the Irish, which is exasperating when one is in a hurry, but which explains many admirable Russian qualities. By good-natured persistence it is possible to circumvent the defence-in-depth put up by the minor ranks of the bureaucracy; and once the foreigner has reached the men who are really doing the work of remaking Russia, he finds himself in an entirely different, exhilarating atmosphere. It is this atmosphere and the work done in it, not the petty ineptitudes of VOKS, which the present book sets out to record.

But before these introductory comments are closed can any explanation be given for the official attitude toward foreigners? I think it can. There are two reasons which explain, even if they do not justify, the official attitude. The first is historical. Although there have been periods of liberality toward the west, Russia always has, on and off, been suspicious of foreigners, especially of diplomatists. A century ago it was difficult to move about Russia ' without intervention by official persons ', and in the old days some envoys found themselves virtually prisoners in Russia.

The second reason is that Russia is engaged on a hazardous social experiment which has passed through three desperate crises in twenty-five years: a famine, a purge, and a war. The State still cannot afford to take risks, and foreigners who wander about unchecked are potential risks. The State still deems it necessary to misrepresent to its people the social conditions of capitalist countries: therefore there must be censorship and consequently some intellectual isolation in Russia. The State does encourage the most vicious internal criticism of Soviet activities; but it cannot afford to have its dirty linen washed in the best-sellers of American journalists. The State is well aware how great is the gulf between what is planned and what is accomplished; it knows how much more education the people need; it realises that the corruption of the bureaucracy which rotted the old Russia is not yet liquidated: and, quite reasonably, the State does not want stories of these defects spread about the world as examples of Bolshevism. Finally, the State knows that the Russian people are not yet contented. They are in a highly receptive mood. They would, if they got the chance, eagerly embrace not only the desirable things in western culture, but also the undesirable things; not only higher standards of living but also lower standards of taste.

In writing this book I have not assumed any special knowledge of science on the part of the reader. I have included in appendices a good deal of information which is not available elsewhere in English, and which will be useful to the professional scientist; but the purpose of the book is to set out as clearly as possible the impressions of a foreign scientist working in a Soviet laboratory in 1945.

Chapter 2

THE ORGANISATION OF SCIENCE

COMPLEXITY OF ORGANISATION; THE ACADEMY OF SCIENCES OF THE U.S.S.R.; SCIENTIFIC WORK UNDER THE MINISTRY OF AGRICULTURE; SCIENTIFIC WORK UNDER THE MINISTRY OF HEALTH.

IN February 1943 there appeared in the British scientific journal *Nature* line and staff diagrams of the organisation of science in the United Kingdom and the Soviet Union. The diagram for the Soviet Union was streamlined, clear, simple, and disarmingly symmetrical. The diagram for the United Kingdom resembled nothing so much as the ground plan of an antiquated and complex system of plumbing. Anyone familiar with British science knows that diagrams of the organisation of science bear little relation to the actual channels of intercommunication, and that the chief liaison office is the Athenæum Club; yet uncritical admirers of a planned economy imagine that in Russia the traffic of science flows really through the planned channels. In my own experience co-ordination of scientific effort is not much more evident in Russia than in Britain; and largely for the same reasons, namely that good scientists are individualists: they work best at what interests them and they cannot always predict a year ahead what that will be. In point of fact, organisation and planning are regarded by many Soviet scientists as irritants, which waste time and do not accomplish much effective co-ordination of effort.

In theory all scientific effort in the Soviet Union is geared into one great machine which works alongside other State machines to fulfil the five-year plan. In practice, science is carried out in little pockets of activity under good leaders, or isolated in immense institutes in the cold and heavy

atmosphere of Russian bureaucracy, than which no bureaucratic atmosphere is colder and heavier. And, as elsewhere, the good scientists are too busy, and the bad scientists are too dull, to know much of what is going on in other laboratories. Accordingly one finds, in a country where science has proliferated as much as it has in Russia, many independent laboratories engaged on practically the same investigations and yet having little or no contact with one another. In Moscow alone, for instance, work on food storage is being carried out in laboratories of the Ministry of Food Industry, the Ministry of Foreign Trade, the Ministry of Fish Industry, the Ministry of Meat and Milk, and the Academy of Sciences. In 'pure' science, too, there is no more streamlining or regimentation than we are accustomed to in the West. Research on such a specialised subject as the genetics of the fruit fly is going on in two separate institutes of the Academy of Sciences, in two separate departments of Moscow University, in the Pavlov Institute, in the Röntgen Institute, and in the Ukrainian Academy of Sciences in Kiev. The difficulties in securing co-ordination between workers in the same field are not reduced by the custom of every ministry to run its own press and every sizeable institute to issue its own publications; and these publications are not only journals, but *trudi*—occasional monographs in which much of the best work appears, and which almost instantaneously go out of print. Publications on biochemistry, for instance, may appear from the press of the Academy of Sciences, any University, the Academy of Medical Sciences, the Lenin Academy of Agricultural Sciences, or the Ministries of Food, Foreign Trade, Health, and Agriculture. Even the title of a journal is not a reliable guide to the kinds of papers it contains; and it required a search in several libraries to discover that in 1944 papers on entomological research appeared in over 200 different journals in the U.S.S.R. The complexity of the organisation of science in Russia is still further increased

by the fact that every one of the independent republics has scientific research institutes of its own; and there is a score or more of research institutes attached to the trade unions.

Nothing less than a committee of Soviet scientists could do justice to the task of describing the organisation of science in the Soviet Union. There is no published handbook of scientific institutes. There is no up-to-date guide to scientific research. It is almost impossible to secure from the several government departments even a selected list of their institutes. Accordingly my material for this chapter is incomplete: but I have enough to illustrate the opportunities for scientific research in Russia and the conditions under which Soviet science operates. All scientific work in Russia is under government control, either through the Academy of Sciences or through one or other of the numerous Ministries. These Ministries were formerly called People's Commissariats, but in March 1946 the words 'commissar' and 'commissariat' vanished by decree from descriptions of the Soviet Civil Service. Even scientific research in Universities and technical colleges is covered by this generalisation, for all such institutes are now under a Ministry for Higher Education.[1] The organisation of science in Russia will be illustrated by reference to scientific activities under three of these controlling bodies: the Academy of Sciences, the Ministry of Agriculture, and the Ministry of Health.

The Academy of Sciences

The Academy of Sciences was founded in 1725 under the patronage of Peter the Great, and on the model of the Royal Society of London. It was for a long time almost the only coherent body of intellectuals in Russia. It was taken over by the Bolsheviks at the time of the Revolution and reconstituted in 1925 as 'the Academy of Sciences of the U.S.S.R.', since when it has enjoyed State patronage on a

[1] See Chapter 4.

scale beside which government support of learning in other countries looks very shabby.

The Academy combines, among others, the functions of the Royal Society and the Department of Scientific and Industrial Research. It covers not only science, but literature and language, philosophy, history, economics, and law. It consists of a very select body of 139 Academicians whose mean age is about 65, and a scarcely less select body of 198 corresponding members, whose mean age is scarcely less than 65. Most (though not quite all) of these men were appointed for their distinction as scientists, and it is no exaggeration to say that the Academy is a more difficult body to enter even than the Royal Society of London.

Unlike the Royal Society, which exacts a subscription, the Academy rewards its members with a handsome salary. Academicians receive 3,000 roubles a month,[1] simply for being Academicians; and corresponding members receive 1,500 roubles a month.[2] This emolument is but one of the privileges accorded to Academicians. In addition they have very liberal rations for food and clothing. They may shop at a special store which stocks materials not available in ordinary stores. They receive a discount at the Commercial shops. They are given cars. Every Academician is entitled to a comfortable flat in the city. And it is planned to provide, for the relaxation of Academicians in the summer time, a large number of country cottages, built all together in one village, and each surrounded by an orchard.

Elections to the Academy are made by the votes of Academicians on the recommendation of expert committees, who take into account not only scientific eminence but also 'character' and service to the State. The procedure is attended by a good deal of publicity. Two months before the elections the names of candidates (the number greatly

[1] Raised on 1.4.1946 to 5,000 roubles.
[2] Raised on 1.4.1946 to 2,500 roubles.

exceeding the number of vacancies) are published in the newspapers. This is followed by extravagantly laudatory articles, resembling the publishers' 'blurb' on the dust cover of a book, written by the candidate's supporters. The articles have such attractive titles as: 'A worthy candidate'; 'An outstanding Soviet clinical physician'; 'A keen surveyor of mountain deposits'. For two months there is an opportunity for anyone to write publicly or privately what he thinks about the candidate, undeterred by any risk of a libel action. *Izvestiya* comes out with a leader: 'Unfortunately some scientific research organisations, when submitting the names of candidates to the Academy of Sciences for the chemical section, propose persons who are known not so much for their own scientific work as for their participation in scientific-organisational work'. In September the papers announce that the Academy sessions have begun. Thirty-six full members are to be chosen from 224 candidates, and forty-two corresponding members are to be chosen from 467 candidates. The elections take place and the names of the successful candidates are announced.

This may appear a somewhat bizarre procedure for elections to a learned academy. But it seems to work very well. Nearly all the Academicians are first-class scientists or scholars, and the entrepreneur of science is not admitted unless he has other claims to scientific status. In judging the scientific merit of candidates the Academy is extremely conservative, and the revolutionary in science cannot hope to be elected until his views are so widely accepted as to be no longer revolutionary. Politics plays a very minor part in the election of Academicians. Here and there a man has been elected to the Academy on political rather than intellectual merit, notably the notorious Academician Lysenko (see Chapter 5); but these rare and egregious exceptions do not seriously weaken the imposing intellectual strength of the Academy.

The Academicians and corresponding members run the

Academy; but its activities are on such a vast scale that they simply determine policy, mainly through their Praesidium (council), and they leave the management to the officers and a large full-time staff. The President of the Academy (at present the physicist S. I. Vavilov) has the salary, status, and privileges of a Minister. He lives in a special residence and devotes all his time to the Academy. He is eligible for re-election and may serve for very many years; the last president (V. L. Komarov) was President from 1936 to 1945. The election of the President is accompanied by leading articles in the newspapers. His movements and pronouncements appear in the press almost every week. His photograph is familiar to millions of people.

To the Academy's original function as an aristocracy of science has been added its function as manager of scientific laboratories and as scientific adviser to the Government. The Academy finances and controls 57 institutes, 16 laboratories, 15 museums, 31 commissions and committees, 73 libraries, 35 research stations and 7 societies.[1] In January 1945 its scientific staff alone consisted of 4,213 workers and 600 research students (aspirants),[2] in addition to large numbers of technical assistants, laboratory workers, librarians, secretaries and accountants. The libraries under the Academy are said to contain over ten million volumes.[3] There is an Academy bookshop in Moscow; an Academy press; a splendid Academy rest home near Moscow where Academicians and their families may retire for a month or six weeks in the summer[4]; and another

[1] *220 let akademi nauk S.S.S.R.* Spravochnaya kniga 1945.

[2] *Ibid.*, p. 306. The Academy has the power to grant its own doctor's degree.

[3] *Ibid.*, p. 307.

[4] Children are not allowed in the rest home; but as most Academicians are grandparents, this is not a serious restriction. It might be supposed that Academicians find it difficult to 'retire' in the very close company of dozens of other Academicians. But in fact they wander about the grounds separately, passing the time of day, but rarely forming aggregates except for an occasional game of billiards or chess.

splendid rest home on the shores of the Black Sea. The Academy's budget for the year 1945 to 1946 was 200 million roubles.

Clustering round the Academy of Sciences, but independent of it, are the seven 'filials', academies of the various republics. These are miniatures of the Academy of Sciences of the U.S.S.R., and they are financed by their own Governments.

Readers who wish to see statistics about the various institutes in the Academy and about the Academy's publications, are referred to Appendix 1 (page 207). The organisation of research in the Academy is as follows:—

The 57 institutes of the Academy are organised under eight divisions, as follows: (i) physico-mathematical science, (ii) chemical science, (iii) geological and geographical science, (iv) biological science, (v) technical science, (vi) history and philosophy, (vii) economics and law, (viii) literature and language. Each division is divided into institutes, laboratories, libraries, museums, commissions and the like. Thus the division of biological science contains 12 institutes, 2 botanic gardens, 5 laboratories, 4 commissions, and 3 societies (see Appendix 1). There is great variation in size: some institutes contain hundreds of workers; some laboratories consist of no more than one room.

Each institute is controlled by a director. Up to April 1946 a man could be director of three or four institutes and receive a salary for all his directorships. Thus Academician Tsitsin is director of the Moscow Botanic Garden, the Agricultural Exhibition, the Institute of Remote Hybridisation, and the Moscow State Experiment Station for Grain Culture. For all these jobs he received salaries and in addition emoluments for being an Academician and a member of the Lenin Academy of Agricultural Sciences. By a recent decree, salaries of professors and directors of institutes have been nearly trebled, but a director cannot collect more than one salary for his various directorships;

though he can still receive emoluments from the Academies to which he belongs. It is a feature of the organisation of science in Russia that senior men are grossly overworked. A man who directs three institutes cannot remain long enough in any one of them to do much creative work. In fact one finds that some first-class Soviet scientists are almost constantly in motion or dissipating their energies on committees: a situation not unfamiliar to scientists in countries outside Russia.

Another feature of directorships in Soviet research institutes is that there is no age limit for retirement. It is widely believed that modern Russia is managed by young men. For science, at any rate, this belief is unfounded. By and large, science is in the hands of old men. Academician Bach, up to the time of his death in his ninetieth year (May 1946), was director of the Institute of Plant Physiology and the Institute of Biochemistry. Academician Joffe, who is 67, is director of the Physico-technical Institute and the Institute of Physico-agronomy. Academician Stern, who is 69, is director of the Institute of Physiology and professor in the Moscow Medical College. Academician Obruchev, who delivered an oration on Soviet Geology at the Academy celebrations in 1945, is 83. Academician Varga, who directs research on Economics, is 66. Academician Zelinsky, who is still prominent in Moscow scientific circles, is 85. Some of these men are still remarkably active and they really control their institutes. Others are somewhat frail, and the *de facto* control of their institutes has fallen to deputy directors, the unenviable position of deputy director being held often by a man already in his sixties. A man young enough to have begun his university education under the Soviet régime might by now be in his middle forties: quite old enough to take the lead in Soviet science. Yet only thirteen scholars born in the twentieth century have been elected to the Academy; six of these are writers on philosophical or economic affairs; one is an explorer; and only six are scientists.[1]

[1] Data from *220 let akademi nauk S.S.S.R.*, 1945.

It is clear that scientific research in Russia is under mature and conservative leadership. The internal organisation of research institutes supports this conclusion; it is one of the best features of scientific research there. It is the custom for the director to divide his institute into small and almost autonomous laboratories, each under a leader, who is a senior man, and with not more than four or five assistants. The Institute of Plant Physiology, for instance, is divided into ten laboratories: for photosynthesis, water relations, fruit ripening, winter resistance, and so on. The leader of each of these laboratories is a doctor of science or a professor. (A doctor of science has reached a standard at least equivalent to the D.Sc. of a British University. If a doctor of science holds—as he commonly does—a teaching appointment concurrently with his position in the institute, he has the title of professor.) The four or five assistants in his laboratory are either senior (*starshi*) or junior (*mladshi*) workers; the former correspond roughly to workers holding an M.Sc. or Ph.D. degree, and the latter correspond to post-graduate students. Both senior and junior workers have assigned to them certain duties in the institute: to keep a record of reagents used, for instance, or to be responsible for maintaining balances or microscopes. Senior and junior workers are permanent employees, on a rising salary scale, and with prospects of promotion provided they do research. Beside these permanent employees there are a few workers on what we should call research studentships. These are the aspirants and candidates referred to in Chapter 4 (page 95). Each laboratory has a 'laborant' who is a skilled laboratory assistant, always with a secondary and sometimes with a tertiary education. There is a shortage of unskilled workers, and the research worker in the Academy must be prepared to do his own washing-up and some of his own cleaning. Beside the staff in these laboratories there is a staff of accountants and secretaries, large compared with that in a British research institute. There are usually one or two ante-

rooms to the director's office; in these are to be found a secretary (very often it is the secretary who is responsible for the political activities of the institute), together with the invariable accompaniment of every Russian office: two or three women equipped with a yellow and black abacus each, and sitting, each with a shawl over her head, waiting for something to do. The Russian trait of fondness for bureacracy has spread to the Academy, and there seems to be a great deal of superfluous writing of reports, making of estimates, and book-keeping, in even the best scientific institutes.

A good deal of this clerical work revolves around the plan. Each institute has to compose a five-year plan (this was being done in the autumn of 1945) and an annual plan. The plans are drawn up in great detail and published.[1] At the end of each year (and of each five-year period) the institute has to state to what extent the plan has been fulfilled. An organisation which 'overfulfils' its plan may receive congratulations in the daily press. An organisation which habitually 'underfulfils' its plan may find itself exposed to pitiless and scathing criticism, also in the daily press. It is my impression that the plan, so far as pure research is concerned, is more of a nuisance than a benefit. For applied research it does take the place of the demands of industry in a capitalist country, by giving a general direction to the research worker. But for most research within the Academy the plan is at best a superfluity and at worst an obstruction. The obligation to fulfil an institute's plan is tolerated as a necessary nuisance, and (according to gossip) some scientists minimise its effects

[1] I have before me the annual plan for one research institute. It contains over 120 closely printed pages. Each page is divided into six columns in which are entered the number of each project, its title and *raison d'être*, the name of the worker in charge of it, the scope of the projected research and the methods to be used, the year in which it is proposed to begin and end the research, and a few other particulars. The plan contains also statements of the current needs of the institute and a summary of the institute's general undertakings.

by slipping one year behind in their reports. Then the director can submit as his plan for 1947 what his institute has in fact already done in 1946. At the end of 1947 he rewrites this plan as his annual report and submits as the 1948 plan what is really the 1947 report. By this simple procedure the plan is always fulfilled. Whether gossip is correct or not, the idea is a good one, and can be recommended to scientists who have to do business with bureaucrats.

It was my good fortune to work for a short time in two laboratories of the Academy of Sciences, and my chief impression was one of reassuring familiarity. A Soviet laboratory, when one is accustomed to it, is like a laboratory anywhere else in the world. Equipment is adequate, though there were in 1945 many war-time shortages, notably stop-watches and even graph paper and notebooks. Such apparatus as graduated glassware, analytical balances, and electrical equipment is Russian-made. Precision instruments, especially microscopes, refractometers, spectroscopes, etc., are not Russian-made. Departmental libraries are excellent. It is rare to find the laboratory without half-a-dozen British, American, or German journals on the table, and some zealous young research worker puzzling over one of them with a dictionary. The 'tone' of the typical laboratory is a mixture of earnestness and leisureliness. People are always dropping in, shaking hands all round, and settling down to quiet conversation. There is no strict keeping of hours, no clocking on and off, no regimentation. About lunch-time tea is made in a beaker and the workers eat some black bread and cheese or a sandwich. There seems to be no scrupulous insistence on regular attendance; many of the senior workers have part-time jobs elsewhere; the women have to spend a long time every week in food queues; and the leaders of laboratories are rarely at work before eleven in the morning.

Although the individual is free to work as he likes, there is some corporate life in every institute. Most institutes

have a weekly seminar, where reviews of work are given and discussed at great length. It is common to have a three-hour session, consisting of a two-hour discussion following an hour's paper. Some of these seminars are very interesting to attend, for they illustrate the Russian flair for self-criticism and the Russian willingness to admire objectively the work of foreign scientists. They are quite informal, held in a laboratory or a library, though some modern institutes (for instance, Kapitsa's Institute of Physical Problems) have a special seminar room where the audience faces a life-size bust of Generalissimo Stalin, backed by brightly illuminated red cloth.

Another aspect of corporate life in the Institute is the 'Trade Union of Workers in Colleges, High Schools, and Scientific Institutes'. Each institute has its trade-union branch, and there are periodic meetings to discuss welfare conditions and sometimes to hear talks on national subjects. It is the trade union which arranges accommodation in a rest home for the summer vacation. It is the trade union which enquires into sickness or hardship among the members of the staff, and which puts before the Director suggestions for improving the amenities of the institute.

A third aspect of corporate activity depends upon the Communist Party. Only a minority of the workers in an institute are party members, but all workers are under the observation of the party and (through an agent who is probably attached to the N.K.V.D.[1]) are liable to be arraigned for any persistent political unreliability. No worker knows who the N.K.V.D. agent may be, but, if the conversation turns to political or social affairs, every worker assumes the agent is in the room. The Party

[1] The N.K.V.D. is an abbreviation for the People's Commissariat for Internal Affairs, now called Ministry for Internal Affairs. It is analogous to our Home Office, and one of its functions is to be successor to the O.G.P.U. Naturally I did not discuss the activities of the N.K.V.D. with the scientists I met in Russia, but from other sources it was possible to secure some information about its activities in educational organisations.

supervises a wall newspaper which is a bright feature of the entrance hall of the institute. It carries photographs of such men as Lenin, Marx, Engels, Stalin, Molotov, and Charles Darwin, together with hand-written announcements designed to convey patriotic sentiments or political propaganda. Over and above this, politics do not appear on the surface in a laboratory. The yoke of communism rests very lightly on a worker in the Academy of Sciences, provided he says what he ought to say, or says nothing at all, about politics; and there is no reason whatever to suppose that the Party interferes seriously with his scientific research. A scientific worker should be prepared, of course, to pay formal recognition to the State on special occasions. At the celebrations of the October revolution, for instance, he is expected to show his solidarity with other workers by taking part in the spontaneous demonstration of citizens in the Red Square. But these obligations to the State have their compensations; for the scientific worker is rewarded with better rations, better house accommodation, and more clothes even than a heavy worker in industry.

Finally it is necessary to draw attention to the place of the Academy of Sciences in the Soviet administrative machine. The Academy has both the advantages and drawbacks of being a Government department. It can draw upon enormous funds. It can command land, travel facilities, and resources. It can plan and carry out ambitious programmes demanding hundreds of workers. It plays an important part in determining Government policy. But the funds must be spent, and the plans must be laid, to conform with pressures and influences outside science itself. In my opinion these pressures and influences do not seriously interfere with disinterested research except in the weaker parts of the Academy, where they do bias the progress of scientific work toward practical ends.

The Ministry of Agriculture [1]

The first of two examples I shall give of the scientific activities under a Ministry comes from the Ministry of Agriculture. The whole vast organisation of agriculture in Russia is controlled by a Minister.[2] Under him there is a Chief Scientist (Glavnauk), who is responsible for the scientific work of the Ministry. In the last year for which there are published details, the year preceding the war, the budget for scientific work in agriculture was 356 million roubles. This money is used to maintain about 100 research institutes and 865 experiment stations throughout the Soviet Union. These institutes and stations have a staff of 14,038 scientific workers (7,892 of whom have a tertiary education in agriculture), and 25,469 technical workers and field hands. The scientific staff is recruited from 90 agricultural colleges, which are also among the responsibilities of the chief scientist (see Chapter 3). Some details of the research institutes and experiment stations are to be found in Appendix 2 on page 212.

All agricultural research takes place in one or other of the 100 scientific research institutes. A few of these institutes cover whole branches of agricultural science,[3] but most of them are devoted to particular crops or

[1] Formerly the People's Commissariat of Agriculture. The following description refers to the organisation as it was in 1945. In March 1946, when 'Commissariats' were changed to 'Ministries', the new Ministry of Agriculture was split into two: the Ministry of Agriculture and the Ministry of Stock-Raising. The new Minister of Stock-Raising is A. L. Kozlov.

[2] At present N. A. Benediktov. He is a youngish-looking man, with great energy, and obviously master of his job. He has an impressive knowledge of world agriculture and is very co-operative in discussing his Ministry with foreign visitors.

[3] For instance, the All-Union Scientific Research Institute for Plant Industry; the All-Union Scientific Research Institute for Physico-agronomy; the All-Union Scientific Research Institute for Microbiology; the All-Union Scientific Research Institute for Animal Breeding.

animals.[1] The output from so many laboratories is enormous, and since every research institute publishes its own monographs and pamphlets, and sometimes even its own journal, the whole system suffers acutely from 'over-departmentalisation'. The story goes that the grain research institute in Omsk tried in vain for two years to secure information about the work in an agricultural research institute in Odessa. Finally, in despair the institute at Omsk wrote to the Imperial Agricultural Bureaux in London, and London was able to supply the required information about work in Odessa; and I can match this story with others less dramatic, but no less troublesome to the institutes concerned. From time to time monster All-Union conferences are held. These should open channels of intercommunication between research institutes; but apparently they do not open them widely enough for smooth traffic. One feels that in the Soviet Union there is room for that dubious activity (for which, characteristically, there is no English expression) known as scientific liaison.

One attempt to co-ordinate and improve agricultural research in Russia was the establishment in 1929 of the Lenin All-Union Academy of Agricultural Science. This body is under the Ministry of Agriculture, but it has some degree of autonomy. It is designed on the same lines as the Academy of Sciences: it has the functions of awarding the honorific title of Academician to distinguished agriculturists (to which title is attached an emolument of 1,500 roubles a month,[2]) of managing some special research institutes, and of co-ordinating research as a whole in agricultural science. Under the inspiration of N. I. Vavilov, the Lenin Academy was an immense stimulus to agricultural research in Russia; but under the presidency of

[1] For instance, the Research Institutes for oil-crops; flax; tobacco; potatoes; fodder plants; horses, camels, and donkeys; reindeer; rabbits and furred animals; beekeeping; silk production.

[2] This emolument may have been raised in April 1946, along with the rewards to Academicians, see footnote, p. 20, Chapter 2.

T. D. Lysenko it seems to have fallen on evil days, and it is not regarded very highly by some leaders of science in the Soviet Union. In one respect the Lenin Academy has added to the complexity of organisation of science in Russia; for it has its own publishing department and, quite separately from the Ministry, it issues its own journals and monographs on agricultural research.

The bigger laboratories under the Ministry are dignified by the cumbersome title of All-Union Scientific Research Institutes.[1] These are organised in the same way as institutions under the Academy of Sciences. One finds the familiar small, almost autonomous, laboratories with four or five workers under a leader who is sometimes a very distinguished scientist; the constellation of accountants and secretaries; the women in shawls who sit about in corridors and offices apparently with nothing to do. The institutes are directed for the most part by administrators with a scientific background: often youngish men, without any pretensions to a reputation in research, but with a knowledge of practical problems, and boundless enthusiasm for the possibilities of science applied to agriculture. The director is, of course, obliged to use his institute for the solution of *ad hoc* problems and for the higher levels of extension work (such as summer schools for agronomists). There is clearly great competition to excel in service to the State. An institute which successfully introduces a new variety of crop or a new agricultural practice is rewarded by a liberal prize or even by a medal; and the individual scientist who initiated the successful work may receive as much as 50,000 roubles by way of a prize. This policy encourages publicity for the results of research and high-pressure salesmanship for the wide application of new ideas: both activities not consistent with good work. The foreign scientist has, therefore, to cultivate some 'sales resistance' when he visits an agricultural research institute; for he will hear stories of perennial wheat with

[1] Vsesouzni nauchno-issledovatelski institut.

prodigious harvests, bacterial treatment of seeds which doubles the yield, new potatoes for the Arctic, and new sheep for the deserts, which do not stand up to international standards of criticism. There is no doubt that an enormous amount of agricultural research is of very poor quality and is applied on an industrial scale far too hurriedly. One could not expect otherwise of an organisation which has grown from 236 research workers to over 7,000, and from 122 institutes to over 900, in 25 years, and which has been driven constantly by the whip of 'socialist emulation'.

Although the average quality of agricultural research is depressed by the large number of mediocre workers, there is some work of very high quality, and the average quality of work is rising. The high-quality work is possible because there are some men of outstanding ability in the Ministry, who are allowed to pursue their work with a minimum of interruption. Examples of such men are: Prianishnikov and Zhebrak in the Timiryazev Agricultural Academy; Bukasov, the potato expert, in the Institute of Plant Industry; Travin and Ramensky in the Institute of Fodders; Milanov in the Institute of Animal Breeding; to name only a few. The rising average quality of work is possible because there has been recently an increase in the efficiency with which the State separates genuine from bogus advances in agricultural research, and protects itself from being 'sold a pup' by enthusiastic and not too critical experts. There is, for example, an interesting and elaborate organisation for testing new crop varieties, known as the Government Commission for Seed Testing, under the chairmanship of Academician Tsitsin. The Commission has about 1,000 testing stations throughout Russia, each of about 200 acres. There are twelve members of the Commission, and it meets almost weekly to consider applications from research institutes to have new varieties tested. A sample of a new variety is submitted to the Commission. It is grown at each testing station alongside the standard variety for the district, for three or four seasons. In every season

observations are made by the resident agronomist, of growth, resistance to drought, to frost, to disease, and cooking or milling quality of product, etc. At the end of four years the new variety is either rejected, or accepted for certain districts. Then the Commission issues a certificate of acceptance. The seed is multiplied on Government farms and when there is enough the Government issues a decree prescribing that so many hectares of the new variety shall be sown in such-and-such districts. Not until then are prizes awarded to the scientific worker who originated the new variety and to the institute in which he works.

This machinery is working excellently. On the one hand it prevents new varieties from being prematurely put into circulation; on the other hand it overcomes the ubiquitous conservatism of farmers, who, in Russia as elsewhere, are reluctant to try out new varieties. The result of the Commission's work is that by 1940, 95 per cent. of the crops sown in the U.S.S.R. were varieties recommended after testing by the Commission. The Commission produces annually three publications: (*a*) a list of crop varieties recommended for every soil in every oblast (region) in Russia; (*b*) a list of the yields and other qualities of the varieties under test at every station, side by side with the yields of the standard varieties for each station; (*c*) a handbook of instructions for the 1,000 stations on the method of planting, cultivating, and sampling the varieties under test. I was able to inspect some of the Commission's records, and I have only one criticism of their methods: the variety trials are not subjected to statistical analysis, although they are sown only over an area of 100 square metres, replicated six times.

This is the machinery of agricultural research in the Soviet Union. In Chapter 5 something is said about the fruits of this research.

The Ministry of Health

The second of the two examples of scientific activities under a Ministry comes from the Ministry of Health. This Ministry finances all medical colleges (see Chapter 4) and medical research institutes in Russia. Medical research is on a smaller scale than agricultural research, but it has nevertheless an impressive organisation. Formerly all medical research was under the Ministry in some 35 institutes and laboratories, or in the great All-Union Institute for Experimental Medicine (VIEM); but in 1944 this organisation was abolished and replaced by a completely new one. An Academy of Medical Sciences of the U.S.S.R. was founded. The Academy is directly under the Ministry of Health, to which body it submits a yearly report. All research institutes (as opposed to clinical institutes and institutes for large-scale manufacture of serum and drugs such as penicillin) were transferred to the control of the new Academy. Although the Ministry of Health continues to finance medical research, it now has contact with research institutes only through the new Academy.

The Academy of Medical Sciences is cut to the same pattern as the Academy of Sciences and the Lenin Academy. It brings together the most distinguished medical scientists, dignifies them by the title of Academician, awards them the emolument attached to this title, and at the same time manages a large number of research institutes, a library, and a press. The foundation members of the Academy, numbering 60, were appointed by a decree dated 14 November 1944, over the signature of none less than V. M. Molotov.[1] It is clear from Molotov's decree that the new-born Academy is not to turn its back on the past. Few of the foundation members were born later than 1885, and their number includes such veterans as

[1] *Soviet narodnykh kommisarov S.S.S.R.* Postanovlenie 1580. Moskva. 14.11.1944.

Abrikosov (70 years old), Skriabin (67), Burdenko (67), Stern (69), and Starjesko (69). In December 1944 the foundation members held their first session. The Praesidium was elected, with the surgeon Burdenko as president and V. V. Parin as secretary. It is already clear that the new Academy is setting itself a high standard. It promises to be more exclusive than the Lenin Academy of Agricultural Sciences, and to elect as Academicians only workers of the utmost respectability. The first election of members and corresponding members was conducted with all the formality of an election to the Academy of Sciences. It was announced that there would be forty-two vacancies for members and sixty vacancies for corresponding members. By October 1945, 600 names had been put forward for these eighty-two vacancies. The right to propose candidates belongs to medical research institutes, medical colleges, and scientific societies. On October 23 the foundation President, Burdenko, wrote a long and stirring article for *Izvestiya*, entitled: 'Choose the most Worthy Representatives!' He emphasised that the most important characteristics of Soviet science are 'the dialectical materialistic method, a close connection with practice, the complex approach to complicated problems, and unity of national scientific forces'. Three commissions of experts, he said, had considered the proposals for candidates, and on October 28 the elections would take place. Every day the newspapers carried recommendations for this candidate or that: Professor Vedrov was publicly commended for using penicillin in his work. Under the title 'An Untiring Research Doctor' the claims of Z. V. Ermolyeva were put forward by the aged Academician Gamalea, significantly without mentioning her as the discoverer of penicillin (see Chapter 8). Other distinguished academicians supported their candidates under the titles: 'In the Struggle against Tropical Diseases'; 'On Guard for the Health of Children'; 'Representative of Medical X-Rays'; 'Ideas tested on the Field of Battle'—

this last by Academician Speransky about his nominee Professor Vishnevsky.

On October 31 it was announced that in solemn session the Foundation Members of the Academy of Medical Sciences had elected by secret ballot thirty-nine new members and forty-four corresponding members; less than the advertised number of vacancies, in spite of an assertion in the *Moscow News* (for foreign consumption) that most of the 600 nominees were worthy of the honour. Gurevich, the world-famous originator of mitogenetic rays, was up for election: but in earnest of its high principles, the Academy rejected Gurevich, on the grounds that even twenty years after being discovered, mitogenetic rays were not universally accepted by scientists.

The Academy has launched a vigorous programme to consolidate and to extend medical research. In addition to the institutes taken over from the Ministry of Health there are to be several new institutes. There are to be three divisions: the division of medico-biological sciences; the division of hygiene, microbiology, and epidemiology; and the division of clinical medicine. The institutes, which have a scientific staff of over 800, are grouped among three divisions as follows.

INSTITUTE for:—	DIRECTOR
I. *Division of Medico-biological Sciences*	
1. Experimental Biology	Gurevich
2. Normal and Pathological Morphology	Abrikosov
3. Physiology	Razenkov
4. Biological and Medical Chemistry	Parnas
5. Evolutionary Physiology of the Higher Nervous System [1]	Orbeli
6. General and Experimental Pathology	Speransky
7. Experimental Medicine [2]	Feodorov
8. Pharmacology, Toxicology, and Chemotherapy	Ardova

[1] This is the institute which was formerly directed by Pavlov. It is at Koltushi near Leningrad.

[2] The oldest medical institute in Russia, founded in 1892 in St. Petersburg.

II. *Division of Hygiene, Microbiology and Epidemiology*

9. Bacteriology, Epidemiology and Infectious Diseases	Timakov
10. Viruses	Smarodinsov
11. Malaria, Parasitology and Helminthology	Sergiev
12. General and Communal Hygiene	Sesin
13. Labour Hygiene and Professional Diseases	Chekhlaty
14. Nutrition	Zavarzin
15. Public Health, Medical Statistics, and Social Hygiene (a new institute not yet functioning)	—

III. *Division of Clinical Medicine*

16. Experimental and Clinical Surgery (a new institute not yet functioning)	—
17. Neurosurgery	Burdenko
18. Cancer	Serebrov
19. Neurology	Grashchenkov
20. Haematology and Blood Transfusion	Bagdasarov
21. Gynaecology and Obstetrics	Malinovsky
22. Experimental and Clinical Therapy (a new institute not yet functioning)	Arkutin
23. Tuberculosis	Lebedev
24. Pediatrics	Sbarovskaya
25. Psychiatry (a new institute not yet functioning)	Giliarovsky

The Academy has left a few institutes, or parts of institutes, under the direct control of the Ministry of Health. Notable among these are the Institute for Venereal Diseases and the serum-production department of the Institute of Microbiology. The former library of VIEM has been taken over by the Academy; and the Academy press proposes to issue, in addition to the chief medical journals already in existence and taken over in 1945, *Dokladi* (for short papers), *Vestnik* (for official reports and questions of organisation), and *Trudi* (for occasional monographs). There is every indication that the Academy, while keeping close to clinical practice, will concentrate upon high-grade medical research and will leave all routine work to the Ministry of Health. One common obstacle to medical research in British countries is absent in Russia: namely the serious disproportion between the income from private practice and the salary in medical

research; indeed medical research workers in Russia earn on an average more than practitioners.

The organisation of any single medical research institute follows the pattern by now familiar to the reader. The institute is divided into separate laboratories each under a leader. Facilities such as the library, glass-blowing room, stores, and so on, are common to all laboratories. Some institutes have a chemical or physico-chemical laboratory which is at the disposal of the whole institute for such services as analyses or spectro-photographs, but which is at the same time expected to carry out research on its own account. Short-term, *ad hoc*, research is looked upon with much less favour by the Academy of Medical Sciences than by the Academy of Agricultural Sciences. The old men who were the foundation members have had their way. Research has its eyes on the far horizon, not the near.

These brief descriptions of the organisation of science in the Ministries of Agriculture and Health are only samples from the huge structure of applied science in the Soviet Union. The Academy of Sciences is unique in Russia: there is no other scientific body to compare with it; but the scientific institutes which serve the needs of agriculture and health have their equivalents in a dozen other Ministries. Unfortunately, it was not possible during my stay in Russia (despite dozens of requests on my part) to secure lists of scientific institutes from other ministries; but some idea of the range of institutes in Moscow may be gained from casual conversations and by deciphering the abbreviations on the brass plates beside front doors. The Ministry for Food Industry has scientific institutes for sugar, canning, and starch products; but the former Vice-Commissar for Food Industry, though very friendly, could not arrange for visits to any of these because they are undergoing repairs and redecorations (a process known in Russian as '*remont*'—a magic word used by bureaucrats as a polite way to refuse facilities to a foreigner).

The Ministry for Meat and Milk has scientific institutes for meat, dairy products, and refrigeration. The Ministry for Foreign Trade has scientific institutes for food production, refrigeration, and fur production (the joke goes round Moscow that the silver foxes at the fox farm are better fed and housed than a Soviet worker). The Ministry for Coal has scientific institutes for peat, coal, chemistry, and synthetic rubber. The Ministry for Chemical Industry has scientific institutes for synthetic rubber, nitrogen, and the applications of physical chemistry to industry. The Ministry for Posts and Telegraphs has scientific institutes for radio propagation. The Ministry for Fish Industry has scientific institutes for lake and river fish, pond fish, marine biology, oceanography, deep-sea fisheries, and refrigeration. Even the notorious Ministry for Internal Affairs (N.K.V.D.) has numerous experimental farms in the east where persons who disapprove of the Soviet régime are constrained to do experiments on Soviet wheat and sugar.

The reader may wonder how, in less than three decades, the Russians have produced trained men for these prodigious scientific activities. Here, indeed, is the Achilles' heel of scientific planning in Russia. The enthusiasm of the planners has outrun the human material available to them and instead of building slowly, they have thrown up more and more institutes and filled them with less and less competent workers. I shall defer until the last chapter any discussion of the consequences of this policy. Whether it was wise or unwise, it is rapidly becoming outgrown, for education is beginning to catch up with the planners of science. At this point I shall leave the question of how science is organised, and invite the reader to consider the education of a scientist in the Soviet Union. This is the subject of the next chapter.

Chapter 3

THE EDUCATION OF A SCIENTIST

I—SCHOOL

ORGANISATION; CO-EDUCATION; DISCIPLINE; CURRICULUM; EXAMINATIONS; POLITICAL ORGANISATIONS IN SCHOOLS; EXTRA-CURRICULAR ACTIVITIES; CONTINUATION SCHOOLS

Organisation

EDUCATION in the Soviet Union is under the dual control of the Central Committee of the Communist Party and the Council of Ministers. They determine allocations of finance and the general lines along which education shall develop; and most decrees are issued jointly by both these bodies. The administration of education is carried out under this general authority by State Ministries of Education. There is one of these Ministries for the Russian Soviet Federated Socialist Republic (R.S.F.S.R.) and one for each of the other constituent republics. Instructions from the Ministries are carried out by local education departments, which are also subject to dual control, for they are attached to the organs of local government (*e.g.*, the rayon soviets of deputies).

Although responsibility is deputed to local education officials, authority certainly is not. The Soviet educational system is highly centralised. No decisions of any moment are made at a level lower than the appropriate Ministry of Education. Even such details as the time to be spent on each part of the syllabus, and the time for revision to begin, are determined from the centre by decree.[1]

Some children (in Moscow about one child in six) begin

[1] *E.g.*, a decree was issued on 27 December, 1944, by the People's Commissariat for Education of R.S.F.S.R., giving instructions for the correct organisation of revision in fourth, seventh and tenth classes.

their education in a kindergarten at the age of five. Compulsory schooling begins after the age of seven, and there are three kinds of schools; primary schools, which offer a four-year course, junior secondary schools, which offer a seven-year course, and secondary schools, which offer a ten-year course. The general aim is that all city schools should be ten-year schools. This aim is far from accomplished, and, owing to acute shortage of teachers and equipment, the number of secondary schools in some districts has recently been reduced [1]; and notwithstanding the aim to give every child ten years of schooling, the available evidence leads to the conclusion that in the R.S.F.S.R. out of twenty children who entered the first class in 1935 an average of only one reached the end of the tenth class in 1945. This wastage is of course due partly to the war. Indeed, the war has dislocated Soviet education very seriously, for even up to 1940 the new system had scarcely found its feet. The running of schools in two or three shifts was a commonplace in pre-war Russia: the war has overloaded teachers and classrooms even more. Text-books were short in pre-war Russia: during the war it was usual for the text-books necessary for homework to be shared among three or four children. Paper was none too plentiful in pre-war Russia: in 1944 the People's Commissariat for Education for R.S.F.S.R. ordered the production of 5 million slates and 15 million slate-pencils for schools.[2]

The Soviet Government is fully alive to these difficulties and enormous efforts are being made to repair the dislocations of war.[3] The whole population was urged to

[1] *E.g.*, in Voronezh Oblast the number of ten-year schools was recently reduced from 225 to 100. [2] *Izvestiya*, 17.4.44.

[3] One recent bold step from September 1944 was to lower the age of compulsory attendance at schools from 8 years to 7. The reasons for this are (*a*) to allow children to complete the seven-year course by the time they are 14 (the age of recruitment for industrial schools); and (*b*) to liberate places in crêches and kindergartens, so that mothers may more easily leave their children when they go to work in factories. In the present year—1945–46—in Moscow alone, this brought 70,000 more children to the schools (*Uchitel. Gaz.*, Jan. 1944).

assist in securing the release of schools requisitioned by other departments.[1] Parents, teachers, senior pupils, and party organisations were mobilised to repair schools, to cut fuel for the winter, and to provide canteens for teachers; and every year there was a seasonal burst of criticism that schools in this district or that were not ready for the children.[2] In the present year (1945–46) there are encouraging signs of improvement: 15 million children are attending schools in R.S.F.S.R.; and something over 28 million in the whole of Russia. In Moscow alone 528 schools have opened; over 20 million roubles have been spent on their repair; and they are staffed by 19,500 teachers.[3]

Even the tribulations of the war years have not suppressed the Russian enthusiasm for reforms in schools. One advantage—perhaps the only advantage—of a centralised system of education is that by a stroke of the pen the most extravagant experiments can be initiated; and by another stroke they can be discontinued. The famous Lunacharsky decree on education, signed on 29 October 1917, four days after the Bolsheviks seized power, and expanded in thirty-two articles in a second decree a year later, looked forward to a system of ten years of obligatory schooling; without examinations and without punishments; free; organised in co-operative 'brigades'; co-educational. Up to 1931 there was what the Webbs describe as a period of 'luxuriant experiment, when the lessons of other countries were ignored; discipline was neglected; the pupils were supposed to govern the school; the teachers did as they liked. . . .'[4] In 1931 Bubnov succeeded Lunacharsky as People's Commissar for Education and there began a vigorous retreat to conventional schooling. Knowledge was taught as separate subjects with rigid, prescribed curricula. Discipline was restored. Fees were introduced

[1] *Pravda*, 16.8.43.

[2] *Kom. Pravda*, 1.8.43; *Pravda*, 16.8.43; *Mos. Bol.*, 10.6.44; *Pravda*, 2.6.45; 1.9.46.

[3] *Pravda*, 31.8.45.

[4] *Soviet Communism*, 3rd edition, 1944, p. 725.

for the eighth, ninth and tenth classes. And, most recently, co-education was abandoned.

Co-education

The gradual abolition of co-education began experimentally in 1943 under a decree from the People's Commissar for Education at the time, Potemkin. The ' experiment ' was encouraging, and it was announced in October 1945 [1] that segregated education would be introduced in six more towns and one village in the Moscow Oblast. Co-education, however, was formerly spoken of as a sign of Soviet enlightenment, so the experiment had to be explained to the people. This was done in such terms as the following: Co-education in schools was part of the move to emancipate women. Before the revolution ' there was a bitter struggle for co-education, but its chief motive was to secure equality for men and women, and this motive has now disappeared in the Soviet Union '. Between the ages of 10 and 14 girls outstrip boys and between 14 and 17 boys outstrip girls. Also there are different requirements in men's and women's education. The separation during school hours must be compensated for by joint activities of boys and girls in out-of-school hours.[2]

Discipline

The abolition of co-education is part of a wider policy to tighten up discipline in schools. Owing to the shift system of schooling a child may be home alone for half the day, and ' home ' is usually a single room or part of a room. Both the child's parents, of course, are at work. There is obviously plenty of opportunity for what the Russians, like ourselves, call hooliganism. The Soviet child, if the stories about him are to be believed, has seized this opportunity with both hands. So the theme running

[1] *Pravda*, 9.10.45.

[2] Article by Solokhin in *Kom. Pravda*, 1.8.43.

through most articles on education since 1943 is discipline. The imposition of a stricter code of discipline was explained to the public as follows:—' There was for a long time in the Soviet Union a prejudiced attitude toward obedience, as before the revolution it conjured up ideas of humiliation of self-respect, of the elimination of one's personality before those in higher positions, etc. This fairly well-founded but one-sided conception was made use of by certain champions of the so-called free education school, who maintained that authority and freedom, discipline and independence, obedience and self-respect, were incompatible. The way to genuine internal freedom, to independence and the full development of the personality can only be found through discipline and conscious obedience. . . . Life demands ever more insistently a bolder and more general resort to punishment in the training of character.' [1] The campaign for discipline did not receive unanimous support from the teachers; and in 1944 the head of the Moscow city department of education, A. Orlov, had to criticise ' the untrue and lying theories of teaching which lead to the teacher explaining patiently and persistently . . . it is time to do away with them. . . . The Soviet school must be distinguished from any other school primarily by its strict discipline, because the higher the human society for which the school is preparing young people, the firmer the discipline must be. The regulations in Suvorov schools, where punishment goes as far as the detention cell, have been accepted by teachers.' [2] ' We must declare war ', says another writer, ' on the sentimental and twittering teacher who relies entirely on persuasion and requests. . . . Soviet education requires inflexible strictness and exactness on the part of the teacher.' The introduction of separate education of the sexes will ' give the opportunity . . . for turning our youth into purposeful and bold people, capable of becoming good and able soldiers.' [3] It was, of course, necessary

[1] Article by Propotopopova in *Kom. Pravda*, 16.1.44.
[2] *Mos. Bol.*, 1.3.44. [3] *Izvestiya*, 18.8.43.

to correct any impression that the new discipline was similar to that practised in capitalist schools. 'By means of the stick and intimidation the bourgeois school brought up automatons, crushing and trampling down the will-power and intelligence of school-children and turning them into submissive servants for capitalists and land-owners. In contrast to this system and as a reaction against it the anarchical, petty bourgeois teachers brought forward the so-called theory of "free education" which at one time was introduced into the Soviet school only to be thrown out by the intervention of our party. In the Soviet school education must be conducted on the basis of a correct combination between methods of persuasion and the need for the complete fulfilment by school-children of established rules and order both in and out of school.' [1]

The new discipline included stringent measures to raise the moral level of children outside school hours. Children under 16 are forbidden to visit cinemas or theatres on school days except with special permission, which is given as a reward for proficiency and good conduct; and on no occasion are they allowed to visit cinemas or theatres except in the company of a teacher, a pioneer-leader, or some other adult.[2] In Moscow children under 16 are forbidden to stay on the streets after 10 p.m. except in the company of adults.[3] Parents are reminded that they cannot leave the responsibility for enforcing discipline on their children to the school-teacher alone. It is part of a parent's responsibility to look after the upbringing of children.[4]

But the spearhead of the campaign for discipline was in the schools themselves. In 1943 twenty-one rules for scholars were issued. They are reproduced in Appendix 3 (page 216).[5] They cover behaviour in school and out of it, and

[1] M. Suslov. Secretary to Stavropol Krai party Cttee. *Kom. Pravda*, 16.9.44.

[2] *Pravda*, 4.2.44. [3] *Mos. Bol.*, 1.3.44.

[4] *Code of laws on Marriage, Family, and Guardianship*, p. 41.

[5] Taken from *Pion. Pravda*, 7.9.43.

they take account of the need for cleanliness, for deference to teachers, for thoughtfulness toward old people and children, and the objectionable habit of lounging on the desk during lessons. Teachers say the rules are doing some good, but there has been criticism about their application. They have been perfunctorily learnt, but not inwardly digested. In one school the rules were dictated during the Russian lesson and every child was forced to learn them by heart.[1] In the Ukraine the rules were 'widely discussed' in 1944, but in 1945 'interest has not been sustained and some schools have forgotten the rules altogether'.[2]

There are occasional amusing incidents which indicate that the blustering 'damme sir' Army officer who spits and splutters about the effeminacy of British children has his counterpart in the Soviet Union. In February 1943 Major S. Borzhenko, a Hero of the Soviet Union, visited School No. 425 in the Stalin rayon in Moscow. He was disgusted, and he complained that he did not see on the walls of the school one single picture depicting a military scene. When he went into the ninth class many of the pupils failed to stand up. He asked the pupils what they wanted to be after they left school, and only the children of soldiers intended to enter military schools. 'The pupils spent their break aimlessly. There was lots of snow in the playground, but nobody played snowballs. The pupils of the older classes were smoking in secret in the lavatories.'[3] It makes reassuring reading. Soviet children are as human as British children.

Curriculum

The school curriculum is laid down by the Ministry of Education. It is common to all schools in the State. There is no choice of subjects: every child follows the

[1] *Izvestiya*, 1.12.43.
[2] *Izvestiya*, 22.8.45.
[3] *Kom. Pravda*, 2.3.44.

same course. The current curriculum is contained in the following tables [1] (Table I and Table II).

The curriculum is remarkable for its rigidity and its wide scope. Every child who completes ten years of schooling has covered a course which includes a foreign

TABLE I

Curriculum

Seven- and Ten-year Schools R.S.F.S.R. for year 1943–44.
(Classes per week.)

Subjects. Year :	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Russian language and literature	14	14	10(8)	8	10	8	6	—	—	—
Literature	—	—	—	—	—	—	—	4	5	4
Arithmetic	7	7	6	7	7	—	—	—	—	—
Algebra, geometry, trigonometry	—	—	—	—	—	6	6	6	6	6
Natural History	—	—	2	3	2	3	2	2	2	—
History	—	—	0(3)	2(3)	2	3(2)	2	4	4	4
Constitution of U.S.S.R.	—	—	—	—	—	—	2	—	—	—
Geography	—	—	3(2)	3(2)	3	2(3)	2	3(2)	2(3)	—
Physics	—	—	—	—	—	2	3	3	3(2)	4
Astronomy	—	—	—	—	—	—	—	—	—	1
Chemistry	—	—	—	—	—	—	3(2)	2	3(2)	4(3)
Foreign language	—	—	—	—	4	4	2(3)	3(4)	2(3)	3(4)
Military and Physical Training	1	1	2	2	3	3	3	4	4	5
Design	1	1	1	1	1	—	—	—	—	—
Drawing	—	—	—	—	—	1	1	—	—	—
Singing	1	1	1	1	—	—	—	—	—	—
Totals	24	24	25	27	32	32	32	32	32	32

Note.—The figures in brackets refer to the classes per week in the second half of the year.

language [2]; chemistry, physics, biology, astronomy, and mathematics; literature, political science, and military

[1] Some minor changes in this curriculum were announced in August 1945. The chief of these is to defer till the fourth year the teaching of history, natural science, and geography as separate subjects. In the third year they will be taught as part of the reading lessons.—*Izvestiya*, 7.8.45. In September 1946 it was announced that military training was to be abandoned in girls' schools and would not begin in boys' schools before the eighth class.

[2] Which foreign language is taught in any school depends on the teacher the school happens to have. Thus one school teaches French, another German, another English as its foreign language.

training. When ten years of schooling become widespread, the Soviet Government will be able to assume a constant lowest common denominator of education, as it were, from its citizens.

The syllabus, like the curriculum, is laid down in great detail by the Ministry of Education, and every school is obliged to follow it. In Appendix 4 are given a biology

TABLE II

Curriculum

Seven- and Ten-year Schools R.S.F.S.R. for year 1943–44.
(Hours per annum.)

Subjects. Year:	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Total
Russian language and literature	456	456	294	262	326	262	196	—	—	—	2522
Literature	—	—	—	—	—	—	—	130	164	130	424
Arithmetic	229	229	196	229	229	—	—	—	—	—	1112
Algebra, geometry, trigonometry	—	—	—	—	—	196	196	196	196	196	980
Natural History	—	—	65	97	65	98	66	66	66	—	523
History	—	—	48	81	66	81	66	130	130	130	732
Constitution of U.S.S.R.	—	—	—	—	—	—	65	—	—	—	65
Geography	—	—	82	81	98	81	66	81	81	—	570
Physics	—	—	—	—	—	66	97	97	82	130	472
Astronomy	—	—	—	—	—	—	—	—	—	33	33
Chemistry	—	—	—	—	—	—	81	66	82	114	343
Foreign language	—	—	—	—	130	130	81	116	81	115	653
Military and Physical Training	33	33	66	66	98	98	98	130	130	164	916
Design	33	33	33	33	33	—	—	—	—	—	165
Drawing	—	—	—	—	—	33	33	33	33	33	165
Singing	33	33	33	33	—	—	—	—	—	—	132
Totals	784	784	817	882	1045	1045	1045	1045	1045	1045	9537

syllabus in full and summaries of the syllabuses in mathematics, chemistry, and physics. It will be seen from these examples that the Soviet school syllabus is full, not to say turgid, and there is at present a demand that the school course shall be extended from 10 to 11 years.[1] There is only one way to get through such a formidable syllabus, that is the didactic way, with *ex cathedra* statement; learning by

[1] *Kom. Prav.* 9.8.46.

heart; and in science the minimum of experiment and discussion. This is the way which is in fact adopted in spite of the admirable exhortations in each syllabus. It is significant that one ten-year boys' school in Moscow, which I visited in 1945, was built in 1938 and yet has no chemistry, physics, or biology laboratory; only horizontal desks, a demonstration bench and preparation room for the teacher. Nor were there replicates of chemical or physical apparatus. In this school experiments were set up as demonstrations, each boy in the class having his turn at setting up experiments. I was told that each boy has a hand in thirteen or fourteen experiments a year.

With so much ground to cover it is inevitable that teaching should be perfunctory: but it does not go uncriticised. One newspaper in 1944 complained of the gap between theoretical knowledge and practical experience, and said 'natural science is frequently taught from books alone'.[1]

The whole of the school course is permeated with political propaganda. It is of course true in British schools that such subjects as history, geography, and scripture are taught in the light of conventional British opinion,[2] and the British schoolboy is unlikely, when he learns about India, to become familiar with American or Russian opinion of British rule there. But in Russia this political tendentiousness goes much further: it is emphasised in public pronouncements and it is explicitly written into the syllabus.

[1] *Izvestiya*, 15.6.44.

[2] It is instructive to compare the text-books on Canadian history prescribed for Catholic schools with those for Protestant schools in Montreal. In the former, the bulk of Canadian history occurs before 1763; in the latter, 1763 is almost the starting point for Canadian history. The Russians are zealous in exposing anything they consider to be misrepresentation, or inadequate representation, of the U.S.S.R. in British school books. Thus a recent article by Zaslavsky (*Bolshevik*, no. 15, 1945), contains adverse comments on the sections on Russia in the following books: *History of Great Britain* (T. F. Tout, 1941); *Short History of Britain and Europe* (T. Chadwick, 1940); *Junior History of Europe* (D. K. Gordon, 1942); *Shorter European History* (S. W. Southgate, 1944); and others.

'In the teaching of Russian, emphasis must be laid on the profound patriotism of Russian literature. . . . The teaching of the history of the U.S.S.R. must develop in schoolchildren a love for the heroic past of our people which throughout the whole of its history has displayed unexampled bravery. . . . The Russians stopped the Mongols and saved Europe from them. They saved Europe from being enslaved by the French and Napoleon. They have saved the whole world from the most terrible bondage which ever threatened anyone—the bondage of Hitlerite Germany. . . . The teaching of geography of the U.S.S.R. must reveal the innumerable resources of our great country.' [1]

The official syllabuses of subjects are even more tendentious. Recent editions of the 'Programmes for Secondary Schools' drawn up by the People's Commissariat for Education of R.S.F.S.R. include the following.

(*a*) *Foreign Languages* (*English, French, German*).

In the senior classes reading and discussions arising out of the texts 'must be utilised to impart a communist education and to inculcate selfless love and devotion to our socialist fatherland, the Communist Party, and the leader of the workers of the whole world—Comrade Stalin. . . . A feeling of solidarity with the workers of the whole world who are fighting to free themselves from the yoke of capitalism must be awakened in the pupils. From the eighth class onwards they should read classical and contemporary revolutionary authors in the foreign language out of school hours. . . . In the senior classes, social and political themes must take an increasingly important place.' Among the specified subjects for discussion in foreign languages are the home life of the pupil, 'the happy life of children in our country and the hard life of children in capitalist countries' (sixth class); 'life and work in collective farms and in farms before the revolution; life

[1] *Kom. Pravda*, 16.9.44.

of the peasantry in capitalist countries' (seventh class); 'episodes of the revolutionary struggle in capitalist countries' (tenth class).[1] The material necessary for these discussions is amply provided in the text-books. For instance the English reader for the eighth class at schools (children of about 15 to 16) has passages for translation on the slums of Chicago (Upton Sinclair), the East End of London (Jack London), Children at Work (from *The Underworld* by Welsh), a General Strike in London (Galsworthy), the story of a negro being burned to death in Arkansas (Haywood), an extract about Mr. Squeers (Dickens), John Barton, a Chartist delegate from Manchester (Gaskell), Kingsley's poem 'Three Fishers' (a vignette of the British fishing industry) and some touching anonymous pieces, of which two are reproduced in Appendix 5.[2]

(*b*) *Russian Language and Literature*

The reading of literary texts must be utilised to develop in the pupils the socialist attitude to work. Pupils in classes 5 to 7 will soon learn (in reading Russian literature) 'to condemn some of the characters and to justify others, to hate some and love others. These feelings must be carefully guided.'[3]

In the eighth class the 'course must show the children the connection between Russian and world literature, and acquaint them with the world-wide and historical significance of Soviet literature, the literature which is richest in ideas and the most advanced in the whole world. . . . The Communist orientation must be an essential part of each lesson on literature.'

Shakespeare in translation is very popular in Russia, and

[1] 1940 edition.

[2] E. F. Bushtueva. *English for Middle Schools*, Part IV for eighth class. Leningrad, 1938. See also I. R. Galperin and L. B. Shapiro. *Text Book of English*, Moscow, 1940.

[3] 1942 edition.

some of his plays are included in the course in literature. The detailed syllabus for Shakespeare includes a study of the development of capitalism, and 'Marx on England'. *Hamlet* is used to reveal the exposure of court aristocracy.

(*c*) *Ancient and Medieval History*

The primary aim of the course is to make the pupil realise, through the study of the history of Egypt, Mesopotamia, India, China, Greece, and Rome, the truth of Lenin's statement 'that the development of human communities in every country shows that there was first of all a classless society, patriarchal in character and without an aristocracy, and that this was followed by a society founded on slavery, made up of two classes—slaves and slave-owners.' [1]

(*d*) *Biology* (see Appendix 4 (*a*))

The climax of the course is the integration of organic nature through Darwinism which is used as 'a basis for the proper understanding of the dialectic materialistic interpretation of organic nature'. The course includes in the last year a discussion of 'the anti-scientific, misanthropic race perversions of the fascist "scientists"'.[2]

(*e*) *Chemistry* (see Appendix 4 (*c*))

Among the objects of the chemistry course are:—

'To make the pupil acquire, while learning the facts, theories, and laws of chemistry, and the problems of their practical application, a dialectic material (and in particular anti-religious) outlook on natural phenomena'; and 'to foster in the pupil love for the socialist fatherland by acquainting him with the successes attained in chemistry and chemical industry in our country, and with the achievements of great Russian chemists'.[3]

It might be assumed that one feature of the syllabus,

[1] 1940 edition. [2] 1944 edition. [3] 1942 edition.

particularly in view of the quotation from the Chemistry syllabus, would be anti-religious propaganda. From discussions with teachers about this, I have the impression that the tendency is not to ridicule the religious point of view, as was formerly the custom, but to show that it is inferior to, and inconsistent with, the point of view of dialectical materialism. An interesting statement on this policy was published in a newspaper in 1944:—

'By giving a correct scientific understanding of the essence of the phenomena of nature and human society, the school must dispel the prejudices and superstition of children who are still under the influence of such things. It is no use concealing the fact that among teachers there are people, a small number it is true, who have recently begun to show great tolerance towards religion. Cases of the observance of religious ceremonies by teachers have even increased somewhat. Our party's attitude toward religion is well known and has not changed. Our party fights against religious prejudices because it stands for science, whilst religious prejudices go against science, since all religion is contrary to science.

'By what means does our party fight against religion? M. I. Kalinin gave a good answer to this question in his talk to front-line agitators in 1943. He said "We do not persecute anyone for religion. We regard it as an error and fight it with enlightenment." In conformity with the requirements of our party care must be taken to avoid any offence to the feelings of believers, which only leads to a strengthening of religious fanaticism. It is very regrettable that some of our educationists have shown themselves to be prisoners to religious errors. This is naturally a direct consequence of slack work in the political education of teachers.' [1]

No sketch of the curriculum is complete without mention of military training. From 1943 to 1946 this began in the lowest class and continued to the highest, and it occupied more

[1] *Kom. Pravda*, 16.9.44. Article by Suslov.

time than any other subject in the curriculum except Russian and mathematics (see Table II). It included various forms of physical training, but was predominantly military, and was under the direction of the Russian equivalent of a drill sergeant. For boys it included fencing, bayonet fighting, or occasionally tactical exercises.[1] For girls it included nursing, radio and telegraph operating, and military physical training.[2] Military training is now confined to boys of fifteen and over, but there are special military schools (the Suvorov schools) where boys may go at the age of eight to be trained for commissioned rank in the Red Army.

Examinations

Lunacharsky's famous education decree of October 1918 excluded examinations from the Soviet school. But this sort of lotus-land did not prove to be the most appropriate for raising Soviet youth; and today the Russian schoolboy is as examination-ridden as schoolboys anywhere in the world. It is the old Tsarist system of examinations revived; a modification of the system to be found in the German Hochschule. Except for Russian and mathematics, the examinations are oral and are conducted in a surprising spirit of festivity. In a room decorated with flowers and red cloth there sits the examining commission. This commission consists of two teachers familiar with the subject and a rayon official. For the leaving examinations (in the seventh and tenth classes) a representative of the People's Commissariat for Education is added to the Commission. On a table there is a pile of cards face downwards with three questions written on each. The examinee selects a card at random and has fifteen or twenty minutes in which to think over the three questions and to prepare answers. The examination follows and takes about ten minutes. A familiar and mild way to cheat is to pick more than one card from the pile, and to select for

[1] *Uchitel. Gaz.*, 19.4.43. [2] *Vech. Mos.*, 25.8.43.

the examination the card with the easiest questions. In many examinations the results are announced at once, and in the junior classes at any rate, the examination is followed by the presentation of bunches of flowers to the examiners: a happy touch which the Boards of Examiners for British schools might well envy.

Both before and after the examinations there is considerable newspaper publicity. Thus on the eve of the 1945 examinations a whole page of the newspaper *Komsomolskaya Pravda* was devoted to letters from Academicians, engineers, etc., addressed to children exhorting them to work hard.[1] Another paper, having listed the subjects required for matriculation (Russian language, literature, mathematics, physics, chemistry, history, and a foreign language), goes on to say: 'It is the duty of every school child to play his or her part in the forthcoming examinations with honour, and to show a high standard of knowledge and cultural achievement.'[2] During the examinations there is a sort of running commentary in some papers. A fortnight later the papers are saying that examinations in some schools are reported as ended. 'Excellent' or 'Good' marks were attained by about 70 per cent. of the pupils.[3]

Up to 1944, pupils were graded as excellent, good, medium, bad, and very bad; but this method of grading was not proving satisfactory, and as from 11 January 1944 these five grades were replaced by five 'points', respectively 5, 4, 3, 2, and 1. This five-point system is used to cover not only school work but behaviour. Pupils are marked four times a term. In order to pass into a higher year, pupils must get an average of four points through the year. The main purpose of the five-point system seems to have been to tighten discipline; for the child's marks now depend upon his performance and behaviour almost every hour of the day. The five-point system has become very impor-

[1] *Kom. Pravda*, 20.5.45. [2] *Mos. Bol.*, 18.5.45.
[3] *Red Fleet*, 8.6.45.

tant for the child; for if he finishes secondary school with a high enough score of points, he may enter the university without further examination. A further inducement to score high points is the award of medals at the end of the ten-year course: a gold medal for a score of five points in all subjects, and a silver medal for a score of five points in the subjects required for matriculation and a score of four in not less than three of the other subjects: all only on condition that the score for conduct is 'excellent'. In 1945, in Moscow, about 5 per cent. of the pupils who completed ten-year schools received medals.[1]

It is a very far cry from the meagre and class-controlled schooling of Tsarist times to the gigantic machinery of modern Soviet education. And it is not surprising that in its enthusiasm for the liquidation of illiteracy the Government has found itself bankrupt of facilities. The Webbs noted before the war that performance fell short of promise in education,[2] and it is clear from my own observation and from the Soviet press that this is still true. I have already mentioned the inevitable shift system, which the Russians are most anxious to outgrow.[3] A second shortcoming is that school attendance is not adequately checked up, and there are certainly many children who slip through the net of compulsory education and get very little schooling, or none at all. During 1942 (largely owing to the war) tens of thousands of children received no education.[4] A third shortcoming—and the one that is now being given constant publicity—is the tendency to 'formalism' in teaching. V. P. Potemkin, who was People's Commissar for Education in the R.S.F.S.R., on several occasions emphasised the need to get rid of this evil. 'Its basic symptoms', he said in a recent announcement, 'are a purely mechanical

[1] 5,500 children completed the ten-year school in Moscow; 273 gained medals. In the whole R.S.F.S.R. 2,425 children received medals in 1945. *Izvestiya*, 22.9.45.

[2] *Soviet Communism*, 3rd edition, 1944, p. 747.

[3] *Pravda*, 16.8.43.

[4] *Izvestiya*, 22.7.43.

assimilation of what is being taught; the learning of words and phrases or formulas which have no concrete meaning; the absence of any link between what is taught and life.'[1] The cause of this formalism is not far to seek. 'Trained teachers are in very short supply. About 40 per cent. of the teachers of the senior classes of secondary schools, up to 50 per cent. of the teachers in the seven-year schools, and 15 per cent. in the primary schools still have not the proper education,'[2] and according to the new Minister for Education in the R.S.F.S.R., A. G. Kalashnikov, there is a shortage of no less than 25,000 teachers in the present session, 1946–47.[3] This is certainly one cause: but another, equally serious and much more easily remedied, is the syllabus. The biology syllabus reproduced in full in Appendix B could be interpreted to cover more than first-year university work in Botany and Zoology, beside a good deal of human physiology and genetics. Such a syllabus as this, taught together with no less than ten other subjects, could not be covered except in a slovenly way. It seems as though the Russian education authorities have provided too much of an intellectual feast in their school curriculum; and have accordingly produced in their schools symptoms of mental indigestion.

Political Organisations in Schools

It is a familiar fact that admission to the Communist Party is a coveted privilege, not a right; and that initiation to full membership must be preceded by a novitiate of one or two years. The minimum age for admission for all but soldiers is 20, but the ideals and principles of the Party reach back almost to the cradle. If you go into a class-room of twelve-year-olds you notice that almost all of them

[1] *Pravda*, 17.8.45.

[2] N. M. Parfenova, Head of Administration for Primary and Secondary Schools, of People's Commissariat for Education of R.S.F.S.R., reported in *Uchitelskaya Gazeta* No. 11, 7.3.45.

[3] *Kom. Prav.* 8.5.46.

wear bright red scarves. This denotes that they belong to the Pioneers, the Children's Communist Organisation. Membership of this organisation is confined to children between the ages of 10 and 16. Each member undertakes 'to stand steadfastly for the cause of the workman class in its struggle for the liberation of the workmen and peasants of the whole world'; and 'honestly and constantly to carry out the precepts of Ilych (Lenin) and laws and customs of the Young Pioneers'.[1] There is a newspaper, *Pionerskaya Pravda*, which hotly suppresses any alternative children's organisation in schools.[2] There is a pioneer room at school copiously decorated with red cloth, and with stirring military pictures and portraits of Soviet leaders. Pioneer leaders, who are generally teachers, receive a salary ranging from 350 to 450 roubles a month, depending on length of service.[3] The Soviet child does not have to wait until he is 10 before joining a political organisation, for at the age of 8 he can become a Little Octobrist, and belong to a 'link' of five members, with a Pioneer as leader.

Up to the eighth class in school the red scarf is almost omnipresent. Above the eighth class it has all but disappeared: for now the children are too old to be Pioneers, and ready, if their political record is good, for admission as Komsomols (the All-Union Leninist Communist League of Youth). The Komsomols select their candidates carefully. Membership is permitted between the ages of 14 and 23, with an extension of term for office-holders. The Komsomols are a very powerful organisation. They run a newspaper, *Komsomalskaya Pravda*, which reached its twentieth anniversary on 24 May 1945. They run political schools with a one-year course in Marxism-Leninism for

[1] *Soviet Communism*, 3rd edition, 1944, p. 311.

[2] *Pionerskaya Pravda* makes a violent attack on Pioneers in the fifth class of school No. 26 in Ivanovo for forming a 'Timur Command' in the class. Other organisations '*must not* be created' (*Pion. Pravda*, No. 11 and 13, 1945.)

[3] *Kom. Pravda*, 14.8.43.

'activists'. They conduct purges of their defective members, and they encourage voluntary resignations from children who feel unable to comply with their vigorous discipline.[1]

Induction 'is a great step in the life of a young person'. The function of Komsomols might be described as the education of Soviet Youth for citizenship. There is a strict discipline among members and a high standard of morality and public spirit. Thus when a soldier at the front heard that his wife wished to be unfaithful to him, the soldier wrote to his rayon Komsomol Committee asking the Committee to use this instance as a means of propaganda against loose attitudes towards the family and marriage.[2] Kalinin illustrated another of the functions of Komsomols by saying that such a problem as the struggle for the potato harvest must be put before people in the light of the national need. 'Of course,' said Comrade Kalinin, 'the peasant girl may say to you: "How can I strike the enemy with potatoes?" Such an attitude must be explained away by a discussion of the "vital importance of food supplies for the Red Army"'.[3]

It is among school-children that Komsomols have their greatest influence. They organise mass service, such as cutting firewood for schools, repairing and redecorating classrooms, and helping local Soviets to register seven-year-olds for school attendance. But their zeal does not end with these welcome and boy-scout-like activities. They exert an influence which has sometimes amounted to interference on school life. They organise discussions with parents on new measures, such as the abolition of co-education. And in the past they have exerted an undue influence even on the appointment of teachers. 'In

[1] In the Omsk Oblast a young person voluntarily resigned because after reading the Komsomol statute 'he decided he was not capable of living up to it'. *Kom. Pravda*, 3.6.45.

[2] *Kom. Pravda*, 1.4.45.

[3] Kalinin's speech was made in 1942, but this reference appeared in *Kom. Pravda*, 11.3.45.

preparing for the new year,' wrote one correspondent, 'it is particularly important to pay attention to the teaching personnel, and the Komsomol organisation must play a leading role in this connection.' [1] But the teachers have kicked, and this way of displaying zeal is no longer encouraged. At the twelfth Plenum of the Komsomols in April 1944 the general secretary, N. A. Mikhailov, warned Komsomols that they must not interfere with the teacher, or criticise him at Komsomol meetings, or make independent investigations into the pedagogical activity of the school. 'This would create a violation of the unity of authority in the school, and would interfere with the strengthening of discipline.' Legitimate activities of Komsomols include mass political and cultural work outside school hours, assisting in military physical training, and 'in developing a bread network'. [2] This quotation indicates how far the Komsomols had gone in controlling school life.

The Komsomols have other responsibilities toward children outside school hours. There are children's clubs, such as the Pioneer Palaces, but these do not 'solve the problem of extra-curricular political training', and Komsomols are urged to follow the good example of their colleagues in Saratov, and carry on work with children in homes, in dormitories, and on the streets.[3]

Extra-Curricular Activities

The shift system at school, and the fact that 'home' is generally one room or part of a room, makes it very important to provide for the leisure time of children. This the Soviet Government has done very well. In the Lenin Library in Moscow there is a reading room for children, opened in 1942. About 800 children use the library every day. It is attractively furnished, with portraits of writers of children's books round the walls, and exhibitions of pictures, photographs, and maps. In 1944 the staff of librarians

[1] *Kom. Pravda*, 18.6.44. [2] *Ibid.*, 11.4.44. [3] *Ibid.*, 16.3.45.

answered 11,000 enquiries and arranged 79 exhibitions; they even give advice on how to take notes and make a précis.[1] From time to time there is a 'Children's Books Week' when in Moscow and Leningrad children's books are displayed and children's writers appear in the flesh and read their own stories aloud.[2] The People's Commissariat of Education in the R.S.F.S.R. goes to great trouble to produce children's books at low prices. The 1945 plan envisages a kindergarten library which includes a delightful book explaining to seven-year-olds the working principles of a tank, an aeroplane, and a cruiser. Primary school books include Andersen's *Fairy Tales*, *Gulliver's Travels* and *Robinson Crusoe*. Secondary school books include Shakespeare, Schiller, Molière, Stevenson, Jack London, and Chesterton; and a composite volume called *Science and Life*, written by leading Soviet scientists.[3] In order to fill gaps in the literature, prizes of 10,000 roubles are offered for children's books written on themes issued by the Ministry for Education;[4] and in August 1945 it was announced that a great new Children's Encyclopaedia would be produced, under the Chief Editorship of V. P. Potemkin, who was until his death in February 1946 People's Commissar for Education of the R.S.F.S.R.[5] Museums, too, are an essential part of extra-curricular activities. During winter in a building near the Red Square, and during summer in the Gorki Park of Rest and Culture, there are exhibits to illustrate Darwinism and the theory of evolution; a scientist is on tap all the time to answer enquiries, and an eminent biologist appears periodically to demonstrate, with the aid of pithed frogs, the non-existence of the soul. The Darwin museum, founded in 1905 by Kohts, and still under his direction, was actively engaged through the war in giving children illustrated talks on evolution, even in air-raid shelters.

During the war it was customary for healthy children to

[1] *Literaturnaya Gazeta*, 12, 17.3.45. [2] *Trud.*, 16.10.45.
[3] *Liter. Gaz.*, 17.3.45. [4] *Ibid.*, 6.10.45. [5] *Izvestiya*, 29.8.45.

spend most of their summer holidays working on collective farms to bring in the harvest. From Moscow alone in 1943 some 110,000 children worked on the 'farm front'; and in 1942 children did 113·5 million working days on farms. This mass service was organised by Komsomols.

The first post-war summer (1945) saw a revival of the normal activity of Pioneer camps, holiday homes, and sanatoria. Arrangements were made by trade unions to send 1·675 million children to pioneer camps and sanatoria. The sanatoria were for children in poor health. It was arranged for 250,000 sick children to have forty days in sanatoria camps, and for almost 1·4 million children to have twenty-one days in pioneer camps.[1] Preference was given to the children of soldiers, and in 1945 something like one child in twenty had a summer holiday. Some of the pioneer homes are in old country houses; others are in temporary buildings in the country. They are pretty firmly regimented, but the children get extra food, plenty of music and games, and seem to have a very good time.

Continuation Schools

In present circumstances, nineteen out of twenty children leave school before they have completed the ten-year course. There are two reasons for this: the first is a very large voluntary withdrawal of children from school by their parents—in Russia as elsewhere the poor need to have their children earning as soon as possible. The second reason is the compulsory call-up of children for the labour reserves. This call-up occurs mainly from the seventh class. Periodically a quota of children must be supplied by each area. Commissions are set up to find these quotas. The Commissions comprise the Chairman of the town or rayon Soviet, a trade-union representative, and the local secretary of the Komsomol organisation.

Each school is instructed to provide its quota of children.

[1] *Pravda*, 19.5.45.

For instance in 1945 one Moscow boys' school with an attendance of 1,400 had to provide thirty boys from the seventh class for the labour reserve. The seventh class contained 120 boys, and more than thirty were prepared to leave voluntarily: so the quota was over-filled. When the number of volunteers is insufficient for the call-up, teachers select the dullest boys to fill the quota. Children in the eighth to tenth classes are exempt from call-up.

In September 1946 the call-up produced 434,000 boys and girls in Russia between the ages of 14 and 16. More than half were volunteers.[1] The children are sent to factory training schools or to trade and railway schools. A good deal of their training is ' on the job '. They receive a third of the value of the work they do, together with their food and lodging and clothes. Some schools (*e.g.*, railway schools) have a uniform for their pupils. All labour reserve schools are under a semi-military discipline. Slackness is severely punished.

The labour reserves, although they are child labour, have made notable contributions to the Soviet Union's war-time production. The education in a labour reserve school does not replace ordinary school education, and the Soviet Government is tackling the problem of how to save the 2·5 million children trained in these schools since 1940 from illiteracy.

To meet this problem the Government has instituted evening schools, which aim at completing seven-year or ten-year schooling. Attendance is voluntary and responsibility for persuading children to go to these schools is shared by the factory manager, who must create suitable conditions, and Komsomols, who must arouse in the children a desire to attend. It would appear that the response has been somewhat disappointing; probably about a third of the children in labour reserves are attending; and while some papers declare proudly that there are over nearly 2,000 night schools in the R.S.F.S.R., attended by 315,000

[1] *Pravda*, 14.9.46.

children working in industry,[1] other papers complain of bad attendance,[2] and neglect on the part of education departments to provide facilities.[3]

In the country the difficulties in the way of continuation schools are more formidable than in the city, but a gallant effort has been made to organise evening schools for peasant youth. In the autumn of 1944, by Government decree, 4,000 schools were formed in country districts. In these 350,000 young collective farm workers, many of whom left school at 14, continued their schooling. They meet five times a week for four hours at a time and the course lasts for six months; after which there are examinations and the award of certificates.[4] These opportunities ' were accepted with great joy ' by collective farm children.[5] Although they were introduced as a war measure it was recently stated that now the war is over, these evening schools are being extended.[6]

One of the difficulties in rural education in Russia is the shortage of teachers and the varied and irrelevant duties they are called upon to perform. In 1945 the press complained that in a village near Odessa brigades or collective farms, containing persons with secondary education, send for the teacher to read newspapers to them instead of doing it themselves.[7] To meet the urgent need for village teachers the Government has recently (1946) instituted ' 11th pedagogical classes ' in schools, which provide one year of pupil-teacher training.[8]

To sum up: the culmination of secondary education is

[1] *Pravda*, 18.11.44. This is a striking increase over the figures for 1943–44. *Kom. Pravda*, 1.6.44, reports that in 1943 only 150,000 children attended night schools in the 1,005 night schools in R.S.F.S.R. The numbers for 1946–47 are 300,000. *Kom. Pravda*, 6.8.46.

[2] *Kom. Pravda*, 13.3.45. [3] *Ibid.*, 19.9.44.

[4] *Socialist Agric.*, 30.9.44. [5] *Kom. Pravda*, 1.11.44.

[6] *Kom. Pravda*, 13.10.45.

[7] *Izvestiya*, 24.10.45. Letter from Mikhail Shevchuk.

[8] *Pravda*, 15.9.46.

the final examination from the tenth class at school. Pupils who show distinguished merit at these examinations may be admitted without further examination to places of higher education. Other pupils must sit for competitive entrance examinations. The nature of these examinations and the institutes to which they give entrance are the subject of the next chapter.

Chapter 4

THE EDUCATION OF A SCIENTIST

II—UNIVERSITY AND TECHNICAL INSTITUTE

ORGANISATION; CONDITIONS OF ENTRY, LIVING CONDITIONS FOR STUDENTS; DISCIPLINE AND POLITICAL ACTIVITIES; THE UNIVERSITY; MEDICAL EDUCATION; AGRICULTURAL EDUCATION; CHEMICAL EDUCATION

Organisation

ALL tertiary education in the U.S.S.R. is controlled by the Ministry for Higher Education.[1] This Ministry is directly responsible to the Council of Ministers, although it has in fact two masters: this Council and the Central Committee of the Communist Party. The Ministry has power over institutes of higher training (known in Russia as VUZ's, *Vysshie Uchebnie Zavedenia*). It prescribes courses of study from philosophy to textile production. It approves the appointment of professors from Riga to Samarkand. It arranges for the supply of all requirements from spectroscopes to text-books. It dismisses unsatisfactory teachers and rewards good students with bursaries. It draws up an annual budget which exceeds 3,000 million roubles and it is responsible for the five-year plan for higher education. To support it in this gargantuan task the Ministry has a large staff organised into twenty departments. The Minister is S. V. Kaftanov. He has power even to override the views of his Ministry, and is subject only to the Council of Ministers. Kaftanov is one of the great men in the Soviet Union. He is so much in official favour that he had a place on the platform of Lenin's

[1] This Ministry was created in April 1946. It was formerly known as the All Union Committee for Higher Education.

Tomb in the 1945 November 7 celebrations. He is a giant of a man, tall, with broad shoulders, and immense hands. He is very tolerant and patient at interviews. He talks freely about the educational problems of Russia and asks penetrating questions about British education. He plans to exchange university text-books with foreign universities, and he gives the impression that he would encourage the interchange of students between Russia and other countries. It is said that Kaftanov is the son of a peasant from the east of Russia. He has the easy ways of a countryman. There is a natural greatness about the man, due to a blending of assurance and tolerance in his manner.

The Ministry for Higher Education has under it 764 higher educational institutes. Twenty-nine of these are universities; most of the remainder are really staff colleges for the other Ministries. The universities concentrate their attention upon purely academic studies. Their graduates become research workers in the Academy of Sciences, or scholars in museums, or teachers in higher education establishments. Their main purpose is not to produce technicians for industry or even medical men or lawyers; such as these are trained by technical institutes. Medical doctors, for example, are trained in Medical institutes under a Ministry of Health. Lawyers are trained in Law institutes under a Ministry of Justice. Industrial chemists are trained in institutes of chemical technology under a Ministry for Chemical Industry. Teachers are trained in pedagogical institutes under a Ministry of Education. These technical institutes are (like so many Soviet social institutions) subject to a dual control: on the one hand the buildings and other property belong to the Ministry concerned; the Ministry pays the salaries and expenses; it submits for approval courses of study; it manages the research programme of the institute. The Ministry for Higher Education, on the other hand, must approve the syllabus and courses of study, the professorial appointments, the standard of examinations, etc.

The method of dual control seems to work satisfactorily; at any rate there seems to be no strong pressure to have it changed.

The following statistics convey some idea of the quantitative accomplishments of the Soviet Union in the field of higher education.

TABLE III [1]

Years.	Total No. of Higher Educational Institutions in U.S.S.R.	No. of Students (in Thousands).	No. of Institutions Concerned With :—		
			Health.	Education.	Agriculture and Industry.
1914–15	91	112	7	44	26
1929–30	190	204	—	—	—
1940–41	782	565	78	423	238
1942–43	460	227	48	216	175
1944–45	720	455	75	358	249
1945–46	762 [2]	560 [2]	76	390	258

[1] From an article on the development of the Soviet Higher School, by E. V. Chutkerashvili and A. M. Dlin. *Vestnik Vysshei Shkoly*, No. 2, August 1945.
[2] Conversation with S. V. Kaftanov, 1945.

TABLE IV [1]

Higher Education Institutes in principal Russian cities as on 1 January 1945

In R.S.F.S.R.	Institutes.	Students ('000).	In Republics.	Institutes.	Students ('000).
Moscow	72	82·9	Kiev	20	14·6
Leningrad	27	17·3	Kharkov	27	16·4
Kazan	11	7·8	Odessa	16	8·9
Tomsk	6	4·7	Dnepropetrovsk	9	9·1
Saratov	12	7·5	Minsk	4	2·3
Novocherkassk	4	2·1	Alma-Ata	13	7·6
Voronezh	7	4·1	Baku	6	8·1
Yaroslavl	5	2·6	Erivan	9	6·1
Vladivostok	4	2·6	Tbilisi	13	15·1
Vologda	2	0·6	Tashkent	15	12·3
Rostov	8	6·8	Ashkhabad	4	1·7
			Stalingrad	4	1·5
			Samarkand	8	3·8
			Stalino	4	3·9

[1] Chutkerashvili and Dlin, see note 1 to Table III above.

Among the several points of interest in these two tables are the figures in Table III which show the great reduction not only in student numbers but also in institutes during the war. During their invasion of Russia the Germans destroyed 334 institutes of higher education. As soon as the Russians recovered their occupied territories, these institutes were rebuilt and restaffed. During 1943–44, for instance, 128 institutes of higher education were restored in liberated districts. Universities in undamaged parts of Russia 'adopted' universities in liberated areas. In some faculties students were directed to remain in universities and not to enlist, and attendance at a university was lauded as a 'noble task.' [1]

The Soviet Government is not yet satisfied that facilities for higher education are adequate, and the present five-year plan (1946–1950), now in course of official approval, envisages a great expansion. In 1945 fifty-one thousand students graduated. The plan provides for 149,000 to graduate in 1950. In 1945 there were 560,000 students in attendance. The plan provides for 670,000 in 1950. And even this, according to J. I. Agroskin, vice-chairman of the Committee for Higher Education, will not be enough.[2]

Reliable statistics are notoriously hard to get in the Soviet Union, and it is probably one effect of Kaftanov's great ability that a handbook is published of institutes of higher education.[3] The 1945–46 edition has 183 pages. It lists some 720 institutes in 226 towns and cities. A few particulars from this handbook are given in Appendix 6.

Conditions of Entry

Students are admitted to institutes of higher education between the ages of 17 and 35. From the time of the revolution to about 1930, preference was given to the children of workers and peasants and there was a great

[1] *Izvestiya*, 3.9.44. [2] *Moscow News*, 10.10.45.

[3] *Handbook for Entry to Institutes of Higher Education in the U.S.S.R. in 1945*. Moscow, 1945.

increase in the numbers in these categories. This restriction has now been removed completely, and admission rests solely on merit. It is interesting to note that this has slightly but not materially diminished the proportion of workers' and peasants' children attending.[1]

Year.	Workers and their Children.	Peasants and their Children.	Employees and Intelligentsia.	Others.
1925	17·8	23·1	39·8	19·3
1931	45·9	19·4	30·3	4·4
1935	45·0	16·2	36·2	2·6
1938	33·9	21·6	42·3	2·2

All institutes of higher education limit the number of admissions to conform with the teaching facilities available. There is therefore a quota for each institute and in the better institutes there is keen competition to gain places. Thus in 1945 Moscow University had 4,000 applications for 1,715 vacancies and for all higher education institutions in Moscow there were 36,000 applications for 25,215 vacancies.[2] Candidates who won gold or silver medals or who scored 'excellent' (five points) in their qualifying examination from the middle school are admitted without further test, but the admission of all other candidates is by competitive examination. According to new rules promulgated in 1945, these competitive examinations vary from one institute to another. For any of the engineering or technology institutes, the entrance examination covers mathematics, physics, chemistry, Russian, and one foreign language.[3] The examinations take place at the beginning of September. They are preceded in some institutes by short courses to prepare candidates for the entrance examination.[4]

[1] Composition (in percentages) of students in institutes of higher education, from *Vestnik Vysshei Shkoly*, No. 2, 1945.

[2] *Izvestiya*, 21.8.45 and 25.8.45.

[3] *Uchitelskaya Gaz.*, 13.6.45.

[4] *E.g.*, this was done by the Mendeleev Institute of Chemical Technology in Moscow. *Vech. Mos.*, 11.5.45.

Admission to institutes of higher education is generally from the tenth-year course in the middle school; but this is not exclusively so. A small number, not exceeding 5 per cent. of total entries, is taken from the technical schools. Children, it will be remembered, are drafted into these technical schools from the seventh class of the middle school.[1] This transfer all but closes the door to higher education for the child; but there is provision for a few to climb into a technical institute specialising in subjects covering the same field as those they have studied at the technical school.

The Government has provided various privileges to enable demobilised service men and women to attend institutes of higher education. Students who interrupted courses to enlist (there were 2,500 in Leningrad and 2,000 in Moscow Universities alone) may resume their studies where they left off, and they are receiving special tutorial help.[2] Students who left school from the tenth class with a certificate of 'excellent', no matter when they left school, or who left technical schools with a similar record, are admitted to the institute of their choice without further examination.[3] These, too, receive special tutorial help in small study groups. The student body of the Molotov Power Institute in Moscow began the 1945–46 session with 10 per cent. demobilised persons, including twelve girls who had been nurses, radio-operators, or partisans at the front.

Living Conditions for Students

Up to 1940 higher education in Russia was free; but in that year the Government introduced fees. The fees are 400 roubles per annum in capital cities, 300 roubles per annum in other towns, and 500 roubles per annum in institutes for the theatre, music, and art. These fees are

[1] See p. 63.
[2] Statement by S. V. Kaftanov, *Pravda*, 28.9.45.
[3] *Izvestiya*, 5.8.45.

not high, and in fact they do not exclude anyone. Moreover, something like 90 per cent. of students receive bursaries (stipendia) from the Government. The bursary is paid without regard to the occupation or financial condition of the student's parents, and its amount depends on the institute, the subjects studied, the year of the course, and the record of the student. Thus industrial institutes of higher education pay a stipend of 210 roubles per month to first-year students, rising to 315 roubles per month in the fifth year of the course. Some institutes (*e.g.*, those connected with mining, oil, etc.) have higher rates: 315 roubles per month in the first year, rising to 400 or 500 roubles per month. From time to time the values of stipendia in this or that institute are changed; this is one way in which students are diverted from overcrowded institutes (such as the university) to others where students are needed (such as veterinary institutes). Above all these bursaries are the 'Stalin stipendia' for the cream of the students. These are worth 500 roubles per month. Students whose work is given the complimentary grade of 'excellent' have their stipendia increased by 25 per cent. Unsatisfactory students have their stipendia suspended.

In Moscow, and even more commonly in other cities, many of the students live at home. But, especially in Moscow, there is a large population of visiting students who must find board and lodging. For these students dormitories are provided. Life in these dormitories is a good deal plainer and more disciplined than student life in other countries. A typical dormitory in Moscow contained five to ten students per room, with no more than a small table beside each bed. Some of the dormitories have a study room where students can work. There is a modest charge of twenty roubles a month for this accommodation and the use of the bedding. Food is purchased cheaply at a students' dining room, but any extras (and it is extremely plain) must be bought until rationing ends at high prices in the Government commercial shop or open market.

Books are cheap but hard to buy, because editions are so quickly exhausted; to overcome this difficulty some institutes—for instance the Moscow University—stock a hundred or so copies of essential text-books in the library. Medical and dental attention are free, but hard to come by unless the student is really in urgent need. From talking to students I had the impression that they can just manage to live on their state grants, but it needs self-denial and good luck to do so. A glimpse of the domestic conditions in dormitories is given in an amusing newspaper article entitled 'Among the Storms of the World'. The article describes the storms which are constantly raging in a many-storeyed building on the Bolshaya Yakimanka, where 'S.O.S.'s are often heard from the 400 students of the 2nd Moscow Institute of Medicine who live there'. For five months, the writer says, the communal laundry has been undergoing repair, and the students are compelled to wash their linen wherever they can find the facilities, in their friends' houses, etc. But washing is not everything: clothes must also be dried, and in this building there is nowhere to hang them. Seven daring students who hung their sheets and towels to dry in discreet corners of the corridors suffered a defeat when a light breeze, not without the assistance of deft hands, 'blew' all their linen off the lines.

The seven complained to the commandant, who promised to take measures. But a few days later some jumpers, dresses, and slippers belonging to them also vanished. The robber was able easily to pass the porter at the one door of the building, carrying his stolen goods. Nor was there only one robber, nor did he come only once. The winged words of the commandant—'The porter is not responsible for thefts in the communal quarters'—did little to ensure watchfulness as to those who came in and out of this door on business. The students complained to the deputy director of the Institute, but with no effect, since he and the commandant were in the plot. Among the students

whose clothes were stolen were six mothers, some of whom were wives of front-line soldiers or participants in the Great Patriotic War.[1]

Discipline and Political Activities

Freedom for the student to work as he wishes, which is one of the precious traditions of universities, does not exist in Soviet institutes of higher education. At meetings of deans of faculties, the need for stricter discipline is a common topic on the agenda. Thus in Moscow, a meeting of representatives of institutes of higher education decided that discipline had become too lax. 'There had been cases of a liberal attitude in appraising the work of students. . . . Deans must establish stricter control over attendance at lectures. . . . Higher education institutions must not lower requirements for the military-physical preparation of students.'[2] Three institutes were indicated by name: the Moscow Mining Institute, the Moscow Mechanical Institute of Military Studies and the Moscow Peat Institute.[3] Not only are lectures compulsory, but deans are obliged to distribute sufficient homework to students to occupy 20–25 hours per week.[4] A year later[5] there were still complaints about examination standards slipping.

Discipline is maintained by the carrot as well as by the whip. For some years the vicious system of socialist emulation prevailed even in the classrooms of universities. Socialist emulation is not a Russian invention. Indeed the Webbs attribute it to Mark Twain's Huckleberry Finn, 'who when refused leave to go to play with his boy friends, and ordered by his aunt to "paint the fence", introduced this to his comrades as a new game of trying who could most quickly paint so many yards of fencing.'[6] The use of

[1] *Kom. Pravda*, 13.11.45.
[2] *Vech. Mos.*, 16.9.43.
[3] *Izvestiya*, 20.11.43.
[4] *Vech. Mos.*, 28.8.43.
[5] *Pravda*, 26.11.44.
[6] *Soviet Communism*, 3rd edition, 1944, p. 598, footnote.

socialist emulation in Soviet industry has been critically discussed by the Webbs [1] and other writers. It is reminiscent of the house system of sporting events in a public school. The method works well in football or tennis. It undoubtedly raises production in industry. But when it takes the form of competition between professors for examination results it is not free from objection, particularly as the professors themselves are the examiners. The Soviet Government recognised this, and in 1944 socialist emulation was abolished in institutes of higher education. This, as one paper put it, 'removed the brakes which hindered professors and lecturers from strictly evaluating knowledge of their students'. A far less toxic form of carrot is now used: in November 1944 orders and medals were awarded to 456 professors and teachers for their work in higher education.[1]

In all institutes of higher education political coherence is assured through the activities of the Komsomols (see p. 59). The Komsomols, who compose about 50 per cent. of the students in some institutes, supervise political education, standards of citizenship, and moral tone, just as they do at school. The time allotted to Marxism–Leninism in the syllabus is discussed earlier (page 59). This is the foundation on which the Komsomols build. It is their business to see that the student does not remain a narrow specialist, but 'strives to be an active participant in the political leadership of the country'. The university has to produce 'cadres of workers for a state directed by the great ideas of Marxism–Leninism'. The ascetic type of student, who works day and night, speaks in quotations, and thinks in a groove,[2] is not just left alone in the Soviet Union; he is entreated by his Komsomol comrades to take part in social work, to link up his actions with his principles, and to develop qualities of character, love, and friendship. This drilling of the personality is enforced through a simple technique.

[1] *Vech. Mos.*, 10.11.44.
[2] *Kom. Pravda*, 25.6.44.

'Searching and unsparing control and criticism by their comrades is the most effective method of training.'[1] 'Watch your every action', says *Komsomolskaya Pravda*,[1] 'and do not be indulgent either towards your own weaknesses or towards those of your comrades.'

The university staff is not immune from censure by Komsomols. For instance Professor N. Kovalenskaya, of the University of Moscow, drew up a history programme entitled 'Russian Art of the Eighteenth Century'. The programme was bitterly attacked in the Komsomols' newspaper, because in it the professor suggests that Russian art is nothing but a variant of western European art. The paper concludes that 'this is a harmful theory which regards Russian art as provincial in relation to western Europe'.[1]

Beside the Komsomols, there is another political organisation of students, namely the students' trade union. The trade union concerns itself with student welfare and those features of student life vaguely known as amenities. Any grievances which students might have against the staff are aired through the trade union. The trade union arranges vacations in a rest home.[2] It brings to the notice of the management suggestions for improving the working conditions of students.

Widespread and adequate bursaries, strict insistence on discipline, systematic political indoctrination, trade-union solidarity: these are common to all institutes of higher education. But among themselves the institutes vary a good deal and they must be considered separately in order to give an adequate idea of their organisation and curricula. In the following paragraphs this is done for four types of institute: the university; medical colleges; agricultural colleges; and one kind of institute of technology.

[1] *Kom. Pravda*, 17.6.44.

[2] In 1946 the students' trade union was allotted 7·5 million roubles to secure holiday trips for students. *Izvestiya*, 23.5.46.

The University

There are, according to the latest handbook published by the Committee for Higher Education,[1] twenty-nine universities in the Soviet Union. A list of these, with the number of faculties attached to each of them, is to be found in Appendix 7. They vary widely in size and renown. Without doubt Moscow University is in the front rank of Russian universities; its organisation and curricula are summarised in the following paragraphs.

The Moscow State University (MGU) was founded in 1755 through the initiative of Lomonosov, on a German model.[2] It is managed by a Rector, who is appointed by the Ministry for Higher Education and who has approximately the powers of a Vice-Chancellor. The equivalent of the Senate in a British university is the Soviet of the University. This Soviet, subject only to the Ministry for Higher Education, controls the university.

The work of the university is organised in faculties. These cover fewer fields of knowledge than do faculties in British universities. The faculties in Moscow University, with the principal fields of knowledge in which each of them specialise, are as follows:—

1. *Physics Faculty.* Physics, geophysics, physics of metals.

2. *Mechanics—Mathematics Faculty.* Mathematics, mechanics, astronomy, aeromechanics.

3. *Chemical Faculty.* Organic chemistry, inorganic chemistry, analytical chemistry, physical and colloid chemistry, electrochemistry, chemistry of oils, chemistry of fuels.

[1] *Handbook for Entry to Institutes of Higher Education in the U.S.S.R. in 1945.* Moscow, 1945.

[2] The University has (1945–46) over 7,000 students. It has over 150 departments in its twelve faculties (including the department of correspondence courses which rates as a faculty). The total teaching staff exceeds 1,000. Its annual appropriation exceeds 40 million roubles.

4. *Biological Faculty.* Botany, zoology, animal physiology, plant physiology, anthropology.

5. *Geographical Faculty.* Geography of the U.S.S.R., economic geography of foreign countries, cartography, hydrology.

6. *Geological—Soil-Science Faculty.* Geology, agrochemistry, soil science, geophysical methods for reconaissance of useful minerals and fuel-bearing strata.

7. *Historical Faculty.* History of the U.S.S.R., ethnography, historical development of the Orient, history of classical antiquity.

8. *Philological Faculty.* Russian language and literature, classical philology, Slavonic philology, Turkish and Iranian philology, Western languages and literatures.

9. *Philosophical Faculty.* Philosophy, psychology and logic.

10. *Law Faculty.* The science of law.

11. *Economic Faculty.* Political economy.

12. *Correspondence department.* Mathematics, mechanics, physics, astronomy, botany, zoology, geography, Russian language and literature, general literature, art, classical language and literature, Western European languages and literatures, Oriental languages and literatures, history, philosophy, psychology, logic, political economy.

At the head of every faculty there is a Dean. The Dean is appointed by the Ministry for Higher Education. Each dean is responsible for the discipline and the organisation of his faculty. He can impose punishments and can expel students from his faculty. He is chairman of the Soviet of his faculty. This body corresponds to the Faculty Board in a British university and it carries out the same functions. It manages the academic affairs of the faculty. It recommends the names of professors, ' dozents ' (senior teachers without doctors' degrees), and assistants for appointment within the faculty, and it supervises the examinations. In the earlier Soviet universities there were

student representatives on each faculty, but this representation was abolished in about 1930.

Every faculty is organised into a number of departments (each called a '*káfedra*', *i.e.*, chair). These are far more specialised than the departments in a British university. Thus the faculty of biology in the Moscow university has no less than sixteen '*káfedra*', as follows:—Invertebrate zoology, vertebrate zoology, microbiology, ichthyology, hydrobiology, histology, animal ecology, geobotany, plant physiology, dynamics of development, genetics, Darwinism, anthropology, biochemistry, higher plants, cryptogams (lower plants). Each of these departments is virtually autonomous. For instance there is no department of botany with a professor at its head. The professor of plant physiology is independent of the professor of geobotany in the same way that a British professor of botany is independent of the professor of zoology.

Each department has a professor in charge of the chair, assisted by a small staff. Not only the head of the department, but other teachers with a doctor's degree receive the title of professor. Professors received from 2,000 to 3,000 roubles a month until 1 April 1946, on which date their salaries, in Moscow at any rate, were almost doubled. 'Dozents' receive about 1,500 to 2,000 roubles. 'Assistants', who run practical classes but do not give lectures, receive about 1,000 roubles a month.

On account of this organisation within the faculty each department is quite small. The biological faculty, for instance, admits 150 new students a year.[1] The whole faculty never contains more than about 750 students at a time, distributed in five 'years' and in sixteen departments; *i.e.*, an average of about ten per department per 'year'. Under these conditions advanced teaching can be done through informal contact between students and staff, and

[1] In the session 1945–46 there were 600 applicants to enter the biological faculty in Moscow University, and only 150 were admitted.

one finds in many departments the intellectual enthusiasm which is associated with that kind of teaching.

Although advanced work at the university may be in the best tradition of academic life, the first two years of the university course are less conducive to intellectual enthusiasm. Every student in a faculty takes exactly the same course. Lectures are compulsory. Homework is prescribed. Discipline is strict. A substantial part of the course is occupied by Marxism–Leninism and military training, both, of course, obligatory subjects. Here are two typical first-year programmes:—

(*a*) In the Biological faculty:—Mathematics, inorganic and organic chemistry, physics, biology, geology, one foreign language, military training, Marxism–Leninism, Stalin constitution.

(*b*) In the Chemical faculty:—Mathematics, general chemistry, physics, one foreign language, military training, Marxism–Leninism, Stalin constitution.

There are at least thirty-six lectures a week, and no practical work until the end of the academic year, when there is a ' small practical ' (*mali prakticum*) of one month, six hours a day. The lectures are given two at a time, in doublets of forty-five minutes each separated by an interval of fifteen minutes.[1]

In the third year the student (subject to the approval of the professor) selects his '*káfedra*'. He works mainly at his speciality, and takes courses in other departments as his professor directs. The year is spent mainly in the lecture theatre, but at the end there is a ' large practical ' (*bolshoi prakticum*) which extends full time over two months

[1] The time-table for the biological faculty in the first year is:—

Military training . .	6 hrs.	Physics and mathematics	6 hrs.
Marxism–Leninism .	6 „	Biology and geology .	6 „
Foreign language . .	6 „	Chemistry . . .	6 „

This is mild. In some faculties at Moscow University there are as many as forty-six hours a week devoted to compulsory lessons. (*Vestnik Vysshei Shkoly*, No. 2, August 1945.)

and is in some departments a model of what a practical course ought to be.

In the fourth and fifth years the student works almost entirely in his selected '*kafedra*'. He carries out three to four months of practical work at the end of each year. During these two years he is one of a group of four or five under a professor. There is a very large assortment of courses. A sample is given in Appendix 8.

At the end of the fifth year the student sits for as many as forty-five examinations: an examination in Marxism–Leninism, conducted by professors trained at special 'Universities of Marxism–Leninism', and examination in the subject of his '*kafedra*'. These examinations are mainly oral. In addition, he presents a thesis. The student who passes should at this stage receive a degree. But he does not. He is merely qualified to get a job or to begin advanced study. There is some dissatisfaction about this in university circles, which was subdued by a decree issued on 4 September 1945, entitling all persons who have completed university courses to wear a badge.

All university courses occupy five years.[1] There are two terms a year (in 1945–46 they were 1 September to 24 January and 7 February to 30 June). The Soviet student has a working year of about thirty-seven weeks, six days a week, six hours a day, together with prescribed home-work. It does not leave him much time for extra-curricular activities. Even his vacations are organised. Komsomol organisations take measures for 'cultural-mass work' and sport programmes during the summer vacation.[2] Certain trade unions grant 25 per cent. of their rest-home accommodation to students. Engineering students go into factories; agricultural students go on to the farm; medical students go into hospitals. And yet there is some sort of

[1] The qualifying course in most institutes of higher education occupies five years. There are some exceptions, *e.g.*, teachers' colleges (two- to three-year course) and medical colleges (six-year course).

[2] *Trud.*, 3.7.44.

student life. In Moscow University there is a flourishing dramatic society, a musical society, a field naturalists club, a chemical society, a history club, and many more. Political discussion is completely forbidden, and anything corresponding to the ubiquitous Labour Club or Freethought Society of a British university would have to be conducted in secret, with transportation and imprisonment of the ringleaders as the penalty for its discovery. It is important to add that this denial of the right of free speech does not maim the spirit of a Russian university, for two reasons. The first reason is that the average Russian is quite indifferent to politics. The Communist régime, where it is not welcomed, is accepted as something inevitable and tolerable, though hard: like the climate. Hypocrisy is so foreign to the Russian character that the Soviet student does not even bother to rationalise the peculiar inconsistencies of his government. He simply excludes them from his interests. The second reason is that free interchange of ideas, discussion, even disputes, are encouraged in most fields of knowledge. The bitter penalties which attach to free enquiry in politics or philosophy or history do not poison the study of the sciences or literature. It is true that one science, genetics, has been contaminated by politics; but the body of science is healthy in Russia, and even the ulcerous outbreak of Lysenko is slowly being purged from Russian biology. By and large, a Soviet scientist can work and a Soviet professor can teach without regard to politics or national creeds. In spite of the efforts of a minority in Russia who would like to reproduce there the Nazi attitude to science, there is no silly nationalism among Soviet scientists. The anniversaries of Pasteur and Newton were honoured in Moscow as elaborately as those of Pavlov or Mendeleev.

The ideals of university life have survived the iconoclasm of the revolution and are still surviving the schoolboy regimentation of the Soviet student. As recently as 1945 the Rector of Moscow University, I. S. Galkin, published

an article entitled 'Some Questions of Principle in University Education', most of which might have come from the pen of an enlightened British Vice-Chancellor.[1] Galkin points out that it is precisely the 'unity between educational and research work which distinguishes universities from other higher educational institutions. . . . The university is a sort of organic combination of a school and research institution.' He points out that the curricula are overburdened with subjects and that there is far too much differentiation: in the history department of Moscow University, for instance, there are no less than four slightly different courses on the history of the U.S.S.R. Galkin asks for some variation of syllabus among universities, so that a university is not obliged to follow the standard syllabuses prescribed for all universities, but can develop along its own lines. And he makes two interesting suggestions about the staff. He thinks that members of the teaching staff should be freed from all teaching work every sixth year, to devote themselves to research for a year; and he thinks that no chair should be held by the same person for more than eight years running.

These views of Galkin are not mere speech-day flatulence. The whole atmosphere of Moscow University is consistent with these views of his. The ideals are still remote. But ideals they certainly are. This unexpected inconsistency between the university and other Soviet institutions is part of the all-pervading paradox of Russian life. Authors like A. S. Nash, who try, without the skill of Procrustes, to fit the Soviet university into the Communist bed, do a great disservice to the student of Russian affairs.[2] In fact the Soviet university does not fit: and therein lies one of the hopes for the future of Russia.

[1] *Vestnik Vysshei Shkoly*, No. 2, August 1945.

[2] A. S. Nash. *The University and the Modern World.* London, 1945. Mr. Nash is obviously innocent of any knowledge, first, second, or third hand, of Soviet universities. Nevertheless his views have a somewhat pontifical air, which might make them credible.

One way to throw into contrast the characteristics of the Russian university is to observe how a British university impresses a Soviet professor. Happily this has been recorded. In January 1945 Professor A. A. Kosmodemyanski visited Great Britain as a delegate to the world trade-union conference. During his stay he saw something of the universities of Oxford, Cambridge, and London. On his return he wrote an article on the organisation of higher education in Great Britain. The following is a précis of his views.[1]

'The first thing that strikes one is the complete absence of any unity or system in the educational institutions of Great Britain.' Very large contributions are made by private people to school and university education, and many posts in public education are eagerly sought after although they are unpaid. The standard of the entrance examinations to the British universities is somewhat higher than that at Soviet universities. . . . One is struck by the extreme specialisation. The number of subjects studied is small in comparison with the Soviet higher schools. . . . There are very few examinations at British universities: only five or six during the whole university course. The standard of a pass degree is lower than the qualifying standard at a Soviet university, but the standard of an honours degree approximately equals the Soviet standard for entrance to a post-graduate course. . . .

Students of well-to-do parents choose their own tutors at the university, but 'the Dean, or master of the classes, assigns tutors to middle-class students without consulting them'. 'If the students' parents are rich enough, the student can come to an understanding with his tutor, and the tutor does not bother the student during the whole of his three years.' . . . Only 40 per cent. of those who study at Cambridge pass their examinations for the B.A. . . . Women's university education is limited to such subjects as biology, chemistry, and geography. . . . 'If a student

[1] *Vestnik Vysshei Shkoly*, No. 2, August 1945.

really wants to study, and not ride horses and play football, the conditions for study are quite favourable. . . . There are no scholarships (stipends) in the Soviet sense of the word. There are no students who live on scholarships. . . . The prizes do not even cover the tuition fees.'

'The tuition fees at British universities are incredibly high: at Cambridge and Oxford, £300 a year (inclusive of residence it is true). . . . But £300 is more than a skilled worker would earn in a year.'

The teaching staff of a college consists of professors 'who are allowed to deliver lectures just as they please and to include anything they wish in their lectures'. Kosmodemyanski states that the fee for an M.A. examination is very high—about £50. He was impressed with the Fellowship system. He thought there was great confidence in the independence of students, and that this independence was good for the students. He liked the British examination system and the method of training research workers. And he concludes 'It is extremely characteristic of the universities in Great Britain that they first of all train people who will have to rule, since usually the children of the privileged classes study at universities'.

This commentary on British university education by a Soviet professor may raise in the mind of the reader some misgivings as to my commentary on Soviet universities. That is why I thought it only fair to include Kosmodemyanski's views here. Now, returning to the subject, let us deal briefly with three types of higher education outside the university.

Medical Education

There are fifty-four medical colleges in the U.S.S.R. They are all under Ministries of Health. Moscow has three such colleges, known respectively as the First and Second Moscow Medical Institutes, under the Ministry of Health of the U.S.S.R., and the Moscow Medical Institute under

the Ministry of Health of the R.S.F.S.R. Medicine is a popular profession, especially for women, and in 1945 there were five applicants for every vacancy in the three medical colleges in Moscow.

The medical course formerly extended over five years. Recently there was a complete re-organisation of the course, and there is at present a transition taking place from a five-year to a six-year course. In 1945 eleven medical schools switched to the new course. In 1946 another fourteen will follow; twelve more in 1947, and the remaining sixteen in 1948.

The new medical course is divided into three faculties: the faculty of medicine; the faculty of sanitation and hygiene (public health); the faculty of pediatrics. In the larger medical schools students must elect to enter one or other of these faculties. The exact time-table and syllabus were, in 1945, prescribed jointly by the All-Union Commissariat of Health and the Committee for Higher Education. A composite time-table for the medical faculty is reproduced in Table V.[1]

Agricultural Education

All higher education in agriculture is under the joint management of a Ministry of Agriculture and the Ministry for Higher Education. The former owns the property, finances the institution, conducts the research, designs the syllabus. The latter approves the personnel for administrative and professorial appointments, and the syllabus.[2] Since every collective farm has one or more agronomists or similar officials, and since the research institutes under the Ministries of Agriculture and Stock employ over 14,000 qualified workers, higher agricultural education has to be

[1] Compiled from the Study Plan for Medical Institutes, published in 1945 (*Uchebnie plani meditsinskovo instituta-shestiletni srok obuchenia.* Narkomsdrav, S.S.S.R., 1945).

[2] This arrangement may have been modified since the creation of new ministries in 1946.

TABLE V

Time-Table for new Six-Year Course in the Faculties of Clinical Medicine (M), *Public Health* (H), *and Pediatrics* (P)

Subject.	Faculties.	Lectures (hrs.).	Practical (hrs.).	Years of Course.
Marxism–Leninism	M.H.P.	150	100	1, 2
Latin	M.H.P.	—	108	1
Foreign Language	M.H.P.	—	190	1, 2
Physics	M.H.P.	90	54	1
Biology and Parasitology	M.H.P.	108	108	1, 2
Human Anatomy	M.H.P.	136	262	1, 2
Histology and Embryology	M.H.P.	100	150	1, 2
Chemistry	M.H.P.	54	108	1
Biological Chemistry	M.H.P.	192	182	1, 2
Physiology	M.H.P.	164	114	2
Military Medicine	M.H.P.	62	118	2, 5
Microbiology	M.H.P.	102	153	3
Pathological Physiology	M.H.P.	132	30	3
Pharmacology	M.H.P.	102	117	3
Pathological Anatomy	M.P.	102	162	3, 6
Pathological Anatomy	H.	102	126	3
Diagnostic Methods	M.H.P.	200	132	3, 4
General Surgery	M.	132	81	3, 4
General Surgery	H.	98	98	3, 4
General Surgery	P.	98	81	3, 4
Operative Surgery	M.	48	79	4
Operative Surgery	P.	51	68	4
Operative Surgery	H.	48	65	4
Hygiene	M.	96	158	4
Community Hygiene	H.	76	152	4, 5
Hygiene of Nutrition	H.	62	107	4, 5
Labour Hygiene	H.	92	138	5, 6
School Hygiene	H.	46	46	5, 6
School Hygiene	P.	113	147	4, 5
History of Medicine	M.H.P.	34	—	4
Formal Clinical Medicine	M.	152	124	4, 5
Formal Clinical Medicine	H.	107	107	4, 5
Formal Clinical Medicine	P.	90	118	4, 5
Formal Clinical Surgery	M.	124	124	4, 5
Formal Clinical Surgery	H.P.	90	90	4, 5
Skin Diseases and Venereal Diseases	M.P.	62	62	4, 5
Skin Diseases and Venereal Diseases	H.	45	62	4, 5
Nervous Diseases	M.	62	76	5
Nervous Diseases	H.	48	62	5
Nervous Diseases	P.	62	62	5
Organisation of Health Services	M.	51	34	5
Organisation of Health Services	H.P.	48	48	4, 5
Obstetrics and Gynaecology	M.	124	155	4, 5
Obstetrics and Gynaecology	H.P.	96	96	4
Clinical Medicine	M.	120	184	5, 6
Clinical Medicine	H.	92	106	5, 6
Clinical Medicine	P.	92	92	5, 6
Clinical Surgery.	M.	148	184	5, 6
Clinical Surgery.	H.	92	92	5, 6
Clinical Surgery.	P.	120	120	5, 6

TABLE V—*Continued*

Subject.	Faculties.	Lectures (hrs.).	Practical (hrs.).	Years of Course.
Children's Diseases	M.	106	106	5, 6
Children's Diseases	H.	64	110	6
Hospital Pediatrics	P.	92	156	6
Children's Infectious Diseases	P.	64	64	5, 6
Infectious Diseases and Epidemiology	M.	92	92	5, 6
Infectious Diseases and Epidemiology	H.	50	82	5, 6
Infectious Diseases and Epidemiology	P.	62	62	5
Eye Diseases	M.	46	50	5, 6
Eye Diseases	H.	36	36	5, 6
Eye Diseases	P.	32	50	5, 6
Ear, Nose and Throat Diseases	M.P.	46	50	5, 6
Ear, Nose and Throat Diseases	H.	36	36	6
Psychiatry	M.	64	36	5, 6
Psychiatry	H.	42	28	6
Psychiatry	P.	64	28	6
Medical Jurisprudence	M.	36	64	6
Medical Jurisprudence	H.P.	28	56	6
Practical Pediatrics	P.	96	62	5
Child Surgery	P.	64	64	6

conducted on a large scale. There are in the Soviet Union fifty-eight Agricultural Colleges,[1] nineteen Veterinary Colleges, eight Colleges for Mechanisation of Agriculture, three for Irrigation, and three for Forestry. All of them accept students who have completed a ten-year school course, and train them for four to five years.[2] The best of these colleges is undoubtedly the famous Timiryazev Academy, near Moscow, which has on its staff such distinguished men as Prianishnikov, Zhebrak, Maximov, and Nemchinov. The following paragraphs describe some features of the Timiryazev Academy and illustrate the organisation of higher agricultural education.

The Academy was founded in 1865. It originally covered all branches of agriculture and even fresh-water fisheries;

[1] These are all at the tertiary level. There are in addition hundreds of agricultural schools, for children from the seventh to ninth classes.

[2] Depending on the course: thus the agronomy course occupies four years (plus practical work on a farm) and the plant-breeding course five years.

but the study of fisheries, of agricultural engineering, and of irrigation have now been taken over by separate institutes, and there are six faculties remaining in the Academy. Students may specialise in any one of eight divisions:—

TABLE VI

Summary of Curriculum in Agronomy at Timiryazev Agricultural Academy

Subject.	Hours of Study.		Years of Study.
	Lecture.	Practical.	
Marxism–Leninism	128	90	1, 2
Political Economy	90	48	3
Foreign Language	—	170	1, 2, 3
Military Training	60	239	1, 2, 3, 4
Physics	64	82	1
Meteorology and Climatology	36	18	2
Inorganic and Analytical Chemistry	72	134	1
Organic Chemistry	72	36	2
Physical and Colloid Chemistry	36	36	2
Botany	82	96	1
Zoology	36	36	1
Animal Physiology	64	46	1, 2
Microbiology	36	36	2
Plant Physiology	54	54	2
Soil Science and Geology	90	90	2
Geodetics	18	36	1
General Agriculture	80	64	3
Agrochemistry	57	105	3
Plant Breeding	102	92	3, 4
Vegetable Culture	40	24	3
Fruit Culture	42	14	4
Pasture Production	30	30	4
Selection and Seed Production	70	59	4
Entomology and Phytopathology	82	59	3, 4
Nutrition and Breeding of Animals	76	50	3
Zootechny	70	45	4
Plant Introduction	45	30	4
Forestry	28	14	4
Mechanisation	112	116	1, 2, 3
Organisation and Business Management	88	86	4
Food Storage and Food Technology	45	30	4
Statistics	28	28	4
Bookkeeping	—	42	4
Introduction to Agronomy	18	18	1

Agronomy, agrochemistry and soil science, selection and plant breeding, animal husbandry, poultry husbandry, plant protection, fruit culture (horticulture), agricultural economics. In each of these divisions there are thirty to forty-five obligatory courses and some optional courses.

As in all other educational institutions, a rigid syllabus and curriculum are laid down in great detail in the Academy. In the first two years provision is made for a general education, and the course is frequently interrupted to enable students to complete practical agricultural operations on the large estate surrounding the Academy. The table on p. 90 summarises the agronomy course at the Academy.

It is noteworthy that this curriculum has the same scrappiness which is a feature of agricultural curricula in British countries. The three longest courses are Military Training (7 per cent. of the total course), Marxism–Leninism and Political Economy (8 per cent. of the total course), and Mechanisation (5 per cent. of the total course).

The normal number of students at the Timiryazev Academy is 2,700, but the numbers are swollen at present owing to the after-effects of the war, and in the session 1945–46 there were 3,500 students in attendance and about sixty-five post-graduate students. Those who live in (a large majority) are housed in four large dormitories at the approach to the Academy. The Academy has fifty-five chairs (*káfedra*) and about 275 members of the teaching staff. A good deal of research is carried out, and twice a year there are meetings of the whole staff to hear reports on research.

Chemical Education [1]

A student who wishes to become an industrial chemist has two alternatives open to him: he may enter a university, which trains chemists for 'pure research', or he may enter one or other of the institutes for chemical technology. There are twelve institutes of chemical technology in the U.S.S.R.,[2] beside many institutes of such specialised

[1] Some of the material under this heading has appeared in the *Journal of the Australian Chemical Society*, 1946. I am indebted to the Council of the Society for permission to use the material again.

[2] At Dnepropetrovsk, Ivanovo, Kazan, Kiev, Leningrad, Moscow (2), Rubejnoe, Kharkov (2), Chimkent, Yaroslavl.

branches as Chemical Plant Construction, Chemical Technology of Meat Products, Pharmaceutical Chemistry, and so on.

The student who reads chemistry at a university such as Moscow State University enters the Faculty of Chemistry (see page 78). His general elementary courses have already been noted (page 81). The time devoted to the principal branches of chemistry is shown in the following table (Table VII).

TABLE VII

Branch of Chemistry.	Hours.		Year of Course.
	Lectures.	Practical.	
Inorganic	136	300	1
Organic	204	400	2–3
Physical	102	442	3–4
Analytical	51	204	2
Special Courses:			
Crystallography	34	51	3
Chemical Technology	102	—	3
Theoretical Physics	68	—	3
Molecular Structure	68	—	4
Colloid Chemistry	68	68	4
History of Chemistry	68	—	5
Advanced Inorganic	68	68	4
Quantum Mechanics	68	—	5
Spectrochemistry	54	—	5
Biochemistry	40	—	5
Glassblowing	—	34	5

There is marked specialisation in the fourth and fifth years of the course. Thus, a student specialising in the physico-chemistry of metals at Moscow University takes, *inter alia*, the following courses in his fourth and fifth years:—Phase rule, metallography, corrosion, X-ray analysis, chemical thermodynamics.

The course at a Technical Institute is as long as the University course: five years. The most important of these institutes is the Mendeleev Institute of Chemical Technology in Moscow, under the Ministry of Chemical Industry.[1] The Mendeleev Institute has four general

[1] Even institutes do not escape the receipt of medals and orders in Russia. This institute, in common with the Moscow State University, recently received the Order of Lenin.

faculties, and various special departments. The general faculties are:—Technology of organic production, technology of inorganic production, chemical technology of fuels, and technology of refractories. Some details of the courses are as follows.

Standard first year:—Marxism–Leninism; foreign language; higher mathematics; physics; general chemistry; military training; drawing; descriptive geometry; theoretical mechanics.

Standard second year:—Marxism–Leninism; foreign language; military training; higher mathematics; physics; thermodynamics; analytical chemistry; applied mechanics; organic chemistry; resistance of materials.

Details of the time spent on various branches of chemistry are given in the following table (Table VIII).

TABLE VIII

Branch of Chemistry.	Hours.		Year of Course.
	Lectures.	Practical.	
Inorganic	100	115	1
Organic	100	161	2–3
Physical	64	134	3
Analytical	48	280	2
Colloid	40	45	4

In addition to these obligatory subjects there are fifteen special courses in various branches of applied chemistry. Students in their fifth year do not (as they do in the University) engage on a research problem; instead they have to plan a factory or a chemical plant.

Correspondence Course and Extension Work

This chapter would not be complete without mention of the extra-mural activities of institutes of higher education in Russia. It will be seen from Appendix 7 that almost every university has a correspondence department, which ranks as a faculty. On page 79 there is a list of the subjects

taught in the correspondence department of the Moscow State University; the list includes sciences. Students who work by correspondence have to come to the University for regular consultations, and for a course of practical work at the end of the academic year. Since all correspondence students are employed in Government departments (there being no other employment), it is easy to arrange for them to be granted occasional leave of absence from work to attend the University. The staff of the correspondence department is quite separate from the ordinary teaching staff.

Not only the universities, but also many of the professional and technical institutes, have correspondence departments. For instance in January 1944, 15,000 people were learning foreign languages by correspondence from the Institute of Foreign Languages, and new students were coming in at the rate of 1,000 a month.[1] The All-Union Judicial Correspondence College, which is run by the Ministry of Justice and which has twenty-eight branches in cities and towns outside Moscow, has about 10,000 students. The All-Union Financial Economic Correspondence College has 4,000 students.[2] The All-Union Industrial Correspondence Institute celebrated its twentieth anniversary in December 1945, with 3,500 students. There is something almost American about this efflorescence of educational opportunity in Russia. There is even an Institute of Kinematography.

It is considered part of the duty of an academic man to take knowledge to the people. This is done by means of excellent little pamphlets on popular science (for instance, two on evolution by Zavadovsky and by Keller), by broadcasts, and by lectures in factories, parks, and the like. There is a lecturing bureau attached to the Ministry for Higher Education. During the first two years of its existence, the bureau arranged 3,000 extension lectures, attended by 100,000 people per month. In one factory

[1] *Trud.*, 14.1.44. [2] *Pravda*, 25.5.45.

in Moscow I saw wall diagrams to illustrate the Ptolemaic, Copernican, and Newtonian ideas on cosmogony. These were being used to illustrate a course of lectures in the factory.

Post-graduate Work

Universities and technical institutes are primarily intended for undergraduate education. They do not have to bear the responsibility for research work, because there are large numbers of research institutes set up for this purpose. It is however recognised in Russia that education at the tertiary level is inseparable from research, and in fact a great deal of research is carried on in Soviet places of higher education. The bigger universities are organised in such a way that the staff has adequate time for research.[1] The university does not provide many research grants from its own finances, but Ministries will finance research of interest to themselves in university departments. Consequently, the universities are short of money for research unless the research is of interest to some Ministry. Nevertheless some of the most distinguished scholars and scientists in Russia prefer a university chair to the directorship of a research institute, because in a university they can pursue their work without being obliged to adhere to a plan, and with a minimum of the irritating clerical work which hampers the worker in a research institute.

A research worker has to go through a course of post-graduate[2] training. This consists of two years as an 'aspirant', followed by an examination and the presentation of a thesis. If the 'aspirant' passes, he (or she) is called

[1] For instance no member of the staff of the department of Geobotany in Moscow has more than four lectures a week.

[2] *I.e.*, training following the five-year university or technical institute course. It has to be remembered that since no degree is given at the end of these courses, the student is technically not a post-graduate worker.

a 'candidate' and begins research for a doctor's degree. Aspirants receive 600 to 700 roubles a month; 'candidates' about 800 to 1,000.[1] Aspirants and candidates are selected by a Board appointed by the Ministry for Higher Education. They may decide under whom they wish to work, and they are accepted provided there is a vacancy in the laboratory of their choice. Thus it happens that any professor of standing in a university or technical institute may gather a research school around him without having to worry about research grants for salaries, and even though his university or institute does not finance his research.

[1] In 1945. Their salaries were raised on 1.4.46.

Chapter 5

SCIENTIFIC RESEARCH AND DIALECTICAL MATERIALISM

THE EFFECTS OF MARXISM–LENINISM ON SCIENTIFIC RESEARCH IN THE SOVIET UNION; KRENKE'S THEORY OF AGE CYCLES AND REJUVENATION IN PLANTS; LYSENKO AND THE 'NEW GENETICS'; RESEARCH IN POLAR AGRICULTURE; AN EXAMPLE OF POLAR EXPLORATION

EVERY Soviet schoolboy is familiar with the bearded figures of Marx and Engels. Their portraits hang on the wall of his classroom. Enormous coloured sketches of them adorn the city streets on every festival day. Their Communist Manifesto is learnt in every school, and with all forms of higher education comes the obligatory course in Marxism–Leninism—250 hours of it. The student learns how Lenin built the Soviet state on the foundations of dialectical materialism, and how all history and indeed all evolution is in continuous flux, driven by the force of opposing elements. Everything changes because everything contains within itself the seeds of struggle. This conflict of opposites characterises not only the history of ideas but the history of matter itself, and it should be the point of departure for scientific research. Matter, in the final analysis, is resolved into the dialectical opposites of wave and corpuscle. The green plant struggles for a time to prevent the cataract of energy from falling into entropy, and by virtue of this struggle the green plant grows. All life is a controversy between the rising sap of rejuvenation and the yellowing leaf of senescence.

It is with ideas such as these in his mind that the young Soviet scientist begins his research career. Dialectical materialism is the official philosophy and no activity of the State, not even scientific research, may be inconsistent with the official philosophy. This obligation to work within

the framework of one system of philosophy, and to accept *a priori* certain very controversial propositions, is unfamiliar to British scientists. We no longer have to square our data with the Thirty-nine Articles. We do not mix science and philosophy overmuch and we are able to secure acceptance for our work as pure empiricism, without having to fit it into any particular system of philosophy. But in Russia it is, and always has been, otherwise. The nineteenth-century Russian scientist was well advised to publish only such work as did not challenge the tenets of the Orthodox Church or the policy of the Court. The twentieth-century Russian scientist may find that the most convincing experiments are insufficient to justify a theory which runs counter to the views of Marx or Lenin. It is in vain that Lenin said: 'Our teaching is not dogma. . . . Life will show us'; in 1932, at Leningrad, the All-Union Conference on the planning of Genetics and Selection passed a resolution that genetics and plant breeding were to conform with dialectical materialism. Long before that, in a book entitled *Materialism and Empiriocriticism* [1] Lenin laid down the principles on which scientific research should be conducted. Some of these principles have been propounded by Stalin as 'bolshevik axioms', which differ from the usual axioms in that they are anything but self-evident.

There is a copious literature on the significance for science of dialectical materialism; it is easily available to the reader and need not be summarised here.[2] The purpose of this chapter is to discuss briefly the effect which the official Soviet philosophy is having upon scientific research. That this philosophy has given a new impetus to scientific

[1] English translation by A. Fineberg, London, 1938.

[2] Bernal, Levy, and others, in *Aspects of Dialectical Materialism*, London, 1934. Haldane, *The Marxist Philosophy and the Sciences*, London, 1938. Engels, *Dialectics of Nature*, London, 1940. An excellent brief account of the relation between dialectics and genetics in the U.S.S.R. is given by Hudson and Richens in *The New Genetics in the Soviet Union*. Cambridge, 1946.

research in the Soviet Union, no observer could deny. But has it given a new direction to scientific research? Does it (as J. B. S. Haldane claims) enable the scientist to tackle successfully problems which by any other technique could not be tackled successfully? Is it in fact the starting point for research projects in Russia; or is it merely brought in at the end, as a bed of Procrustes into which the results of research are fitted before publication?

The attitude of Russian scientists to these questions can be set out with some precision. The extreme communist view is that Russia cannot accept the scientific heritage of the west, just as she cannot accept the artistic heritage of the west; science must begin over again.[1] This view is regarded as irresponsible by most Soviet scientists and it is even contrary to some of Lenin's statements. A much commoner view, held by such workers as Kapitsa (physics), Fersman (chemistry), Stern (physiology), and echoed by Bernal,[2] is that the science of the western world needs to be re-interpreted in terms of dialectical materialism; the implication being that if this is done, new relationships will emerge. At the other extreme there is the view, widespread among Soviet scientists, but of course not expressed openly, that dialectical materialism has no useful application to the natural sciences, however profitable it may be in sociology and economics. The English mathematician Levy spoke for many Soviet scientists when he said that for science, dialectical materialism ' is primarily an interpretive method rather than a method of detailed investigation '.[3] Scientific research in Russia reflects these views from one extreme to the other. The outstanding impression, however, on the foreigner who works among Soviet scientists, is that the bulk of Soviet science shows no sign of having been influenced by Marxian philosophy at all; it has clearly been carried out by western methods and it conforms

[1] Cf. Prezent. *Yarovizatsia* 6 (9), 1936, pp. 25–52.
[2] *The Social Function of Science*, London, 1939.
[3] *Aspects of Dialectical Materialism*, London, 1934.

to western canons of criticism. That such work as this comes from Russia is simply fortuitous; it might just as easily have come from Britain or America. It is work along the traditional lines of scientific research and any comment on its quality is a matter for experts, and is irrelevant to the theme of this chapter. In contrast to this, the work of a few Soviet scientists (including some of the very best work and some of the very worst) is presented in the inscrutable language of dialectical materialism. An analysis of this work reveals that the philosophy is applied in one of two ways: either it serves as the motivation of the research, or it is used as an additional check on the results after the research is over. In the one case the philosophy is used as a tool, and stands or falls by its effectiveness; in the other case the reader is asked to accept the results of the research *because* they conform to official philosophical beliefs. At its best, experimental work based on Marxism–Leninism does lead to convenient generalisations (though they could have been reached without its use). At its worst, Marxism–Leninism is invoked to justify the rejection of data, not because the data are unsound, but because they do not support the *a priori* assumptions of dialectical materialism.

Let us now consider in some detail two examples of Soviet research which are based on official Soviet philosophy. I have selected examples from fields of research familiar to me, and which illustrate the possible use, but the certain danger, of constraining scientific work within a prescribed philosophical framework.

My first example is from the work of Nikolai Petrovich Krenke, who died in 1939 at the age of 47, leaving behind him a series of brilliant researches on the development of plants. His main work is set out in two books, both in Russian and almost unknown outside Russia.[1] Two

[1] *Phenogenetical Variability*, Vol. I (753 pp.), 1933; Vol. II (340 pp.), 1935. *Theory of Cyclic Ageing and Regeneration in Plants and its Practical Application* (135 pp.), 1940.

peculiarities of Krenke's work identified him as a Soviet scientist: first, the way in which he designed his experiments to elucidate certain dialectic principles which he expected to find in plants; second, the emphasis which he laid upon the practical application of his results, using this pragmatic test almost as though the validity of his experiments depended upon their utility.

His last monograph begins with several quotations from Engels, Lenin, and Stalin, of which a typical example is Lenin's: 'Development is a struggle of opposites'. He then outlines a theory of plant growth which, though it may not have been inspired by Marxian philosophy, is highly coloured by that philosophy. Briefly his theory is as follows.

During its growth a plant passes through an age cycle. The germination of the seed and the rapid growth of the young plant may be regarded as a rejuvenation from the previous generation. As the plant becomes older a contrary process becomes apparent. This contrary process (the 'opposite' of rejuvenation) is senescence. As time goes on, senescence takes more and more control of development until at length the plant dies, to be followed by rejuvenation when its seeds germinate to produce the next generation.

Krenke's theory maintains that although this cycle of development takes place in time it cannot be measured by the passage of time. It is a familiar fact that a well-watered plant or a well-manured plant matures later than a plant which has been poorly watered or poorly manured. Therefore two plants of the same variety may have the same *time-age* (*e.g.*, they may both be twelve weeks old) and yet they may have very different *physiological ages*. Furthermore, if a plant produces side branches, these are, as it were, subsidiary bursts of regeneration; they are physiologically younger than the main stem. So not only does the whole plant go through an age cycle, but each part of the plant has it own subsidiary age cycle. Cuttings from a plant are the same time-age as the part of the parent plant

from which they are taken; but as soon as they begin to grow they are physiologically younger than the parent plant. Regeneration is stronger in them, relative to senescence, than in the parent plant.

By means of very simple techniques on very familiar plants, Krenke was able to measure physiological age. He found that such characters as the shapes of leaves, the size of leaves, the distance apart of leaves, all went through a cycle during ageing. Thus a physiologically young cotton leaf is not very dissected. With increasing physiological age successive leaves are more and more dissected, until a stage of maximum dissection is reached, after which dissection becomes progressively less; so that

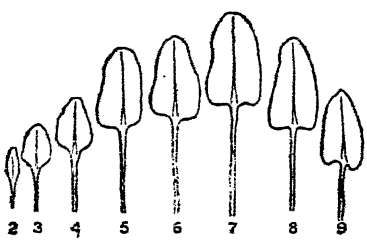

FIG. I.

a very old leaf is something like a very young leaf (Fig. I). This cycle of leaf shape is repeated on the side branches with modifications which depend upon the physiological age of the branch. Thus it is possible to tell the physiological age of any part of a cotton plant from the leaf shape.

Krenke and his pupils made observations of this sort on a great many different plants, and they found that many features of the plant depend upon its physiological age. Not only leaf shape and distance between the leaves, but the chemical composition of the plant, and the properties of its protoplasm, go through a cycle of ageing; and the visible characters can be used as a diagnosis of the chemical condition. Herein lies one of the practical applications

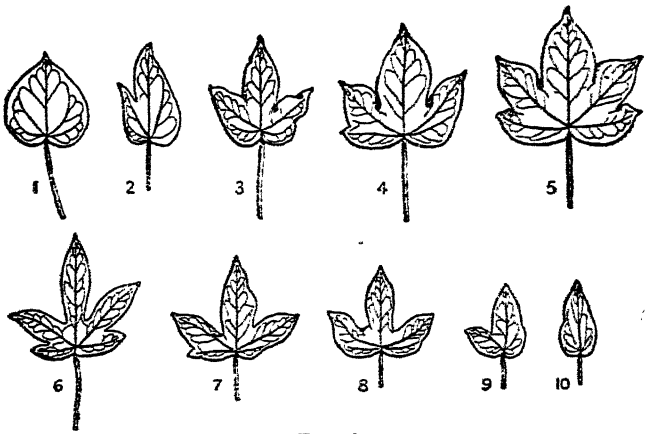

FIG. II.

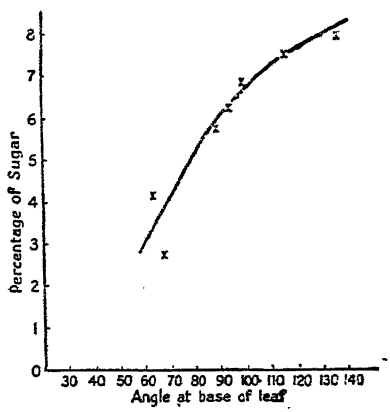

FIG. III.

of Krenke's work. For instance, he has shown that in sugar beet the physiological age is reflected in the shape of the leaves. Between June and August successive leaves

have longer and longer leaf stalks; and between August and October successive leaves have shorter and shorter leaf stalks. Over the same period the angle between the base of the leaf blade and the leaf stalk increases in successive leaves (Fig. II). Thus the ninth leaf and the fourth leaf are about the same size, but have quite different shapes. Krenke found that these visible leaf characters can be used to predict quite accurately the amount of sugar in the roots of the beet. Fig. III, composed from Krenke's data, illustrates how sugar content can be diagnosed from one

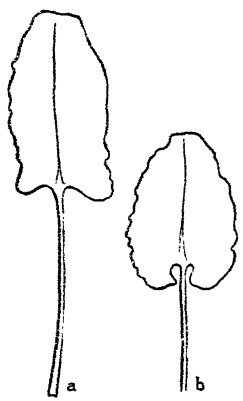

FIG. IV.

leaf character: the angle between the base of the blade and the stalk; and the diagnosis can be confirmed by the use of other leaf characters. In Fig. IV the shapes of two sixteenth leaves, both the same time-age, are compared. The first (*a*) is from a plant which has been well watered. The second (*b*) is from a plant which has been poorly watered. Clearly the two leaves are of very different physiological age, and it can confidently be predicted that leaf *b* comes from a plant with more sugar in it than leaf *a*.

Krenke made an interesting extension of his theory, which is not altogether convincing, but which is nevertheless

less worth serious attention. He claimed that he could pick out, from a number of varieties of a crop plant in the seedling stage, the varieties which would mature early. For instance, he would have claimed that in sugar beet, the variety whose seedlings had the longest leaf stalk, the largest angle at the base of the leaf, and the widest leaf blade, would mature earliest. The assumption that the struggle between regeneration and senescence becomes, as it were, fixed at different levels in different varieties, is a typical extrapolation of dialectics to biology, and it would not be acceptable to most British biologists. However Krenke has applied this method of diagnosis to plant selection, apparently with some success, especially in mulberries (where he used the leaf shape to predict palatability for silkworms); flax (where he used leaf length to predict earliness); hemp (where he used distance between leaves to predict sex of flowers); and cotton.

It could be argued that Krenke's research has nothing to do with dialectical materialism, that it could have been done by a first-class botanist in any country, and that the philosophical basis is not a basis at all, but a decoration applied to the work after it was done. This may be true; but after many conversations with Krenke's colleagues I am inclined to think otherwise, namely that Krenke did begin by making assumptions based on dialectics, and then designed experiments to test these assumptions. His work is not immune from the defects of most Soviet science: it is not statistically sound (although he did use some statistical methods), and any data inconsistent with dialectics are explained away with unashamed sophistry. Despite these blemishes, the work is novel and important, and it is as good an example as one can find of the effect of Marxism on the direction and technique of research.

Notwithstanding its dialectical origin, Krenke's work is a part of world science; it has points of contact with botanical research in other countries. The same cannot be said of the second example I have chosen to illustrate the

application of Marxism to science: the so-called 'new genetics' of T. D. Lysenko. Lysenko's views on heredity are not only novel: they are diametrically opposed to the views of scientists in every country outside Russia. His theories are not only astonishing; they are untenable unless the accumulated experience of most other geneticists is to be disregarded. The story of the 'new genetics' is included here because Lysenko justifies his own work by appeal to dialectical materialism, and he condemns the work of his opponents on the grounds that theirs is inconsistent with dialectical materialism.

The scientific study of heredity, known as genetics, has been carried out in all civilised countries since the rediscovery in 1900 of Mendel's experiments on peas. After Morgan in America had established that Mendel's laws of heredity could be fully explained by the behaviour of visible materials in the cells of animals and plants (the chromosomes), the young science of genetics grew prodigiously; and today there are dozens of chairs of genetics in universities, scores of journals devoted to genetical research, international congresses of geneticists, and genetical research institutes. Russia has made notable contributions to genetics: indeed in some branches of the subject Russia has set the pace for world research. And it is with some bewilderment that the scientific world has heard, over the last decade, reports of a 'new genetics' in the Soviet Union, which denies all the principles of ordinary genetics; condemns the work of Mendel and Morgan as fascist, bourgeois-capitalistic, and inspired by clerics; disdains to use the experimental technique or the canons of criticism of other scientific workers; and talks about the 'souls' of plants and their 'love marriages' [1] when fertilised by mixtures of pollen, happily referred to as 'the lads'.[2]

This 'new genetics' was founded by Lysenko, who was born into a Ukrainian peasant family in 1898. He was

[1] *Biologia razvitia rasteni*, p. 37, 1940.
[2] *Yarovizatsia*, Vol. 1, pp. 25–64, 1935.

trained as a plant breeder and has had a spectacular career, for now, at forty-eight, he is a Vice-President of the Supreme Soviet, President of the Lenin Academy of Agricultural Science, Academician and Member of the Praesidium of the Academy of Sciences, and director of no less than four or five research stations. His 'new genetics' occupies the time of scores of scientific workers, and the space of numerous agricultural journals. His pronouncements have come to have an *ex cathedra* quality reserved usually for dictators or saints. He has fought his way to recognition, not by laborious experiment and careful logic, but with the weapons of the medieval schoolman: appeal to the authority of official philosophy and zeal against heretics. And he claims that his success in applying science to agriculture proves that his theories are true.

All Lysenko's writing is in Russian, and very obscure Russian at that. Therefore it has been impossible for foreigners to get an accurate knowledge of the evidence on which his claims are based. Recently, however, the 'new genetics' was summarised in a masterly essay in English by Hudson and Richens [1]; and in 1945 I visited Lysenko's institute on three occasions, saw his experiments for myself, talked to his staff, and heard him lecture. Accordingly it is now possible to make an objective and accurate analysis of Lysenko's methods and to discuss their relation to dialectical materialism. The following analysis is based on Lysenko's writings, the essay by Hudson and Richens, and my own observations in the Soviet Union.

Lysenko's style of writing, and that of his disciples, are aptly described by Hudson and Richens as follows: 'What is characteristic is not an absence of logic, but an intermixture of logical and alogical methods of procedure. It frequently happens that two or three pages of careful argumentation are followed abruptly by a sudden dart into speculation of an extraordinary type, or into a minute analysis of the motive of their critics, or into quotations

[1] *The New Genetics in the Soviet Union.* Cambridge, 1946, p. 88.

from some approved authority. Such sudden metamorphoses in the style of discourse will not be unfamiliar to those conversant with Russian literature.' [1] It is true that in Dostoyevsky's novels *non sequiturs* are frequent, but the great majority of Soviet scientists do not imitate Dostoyevsky, and in their writing argument is quite clearly developed. Not so the writing of Lysenko, which carries its arguments by quoting authority, denouncing heresy, making innuendoes about the presumed motives of other authors, and appealing to utility as a test of truth.

The first and highest authority is the literature of dialectical materialism. Any observation which illustrates some principle from the works of Marx, Engels, Lenin, and Stalin is *a priori* reliable and convincing. It is no accident that a conference on the 'new genetics' was organised in October 1939 by the editorial board of a magazine entitled 'Under the Banner of Marxism'. From dialectical materialism Lysenko's school draws its first important principle: that since all matter is in a state of flux there can be no stable hereditary characters, independent of the environment; no so-called 'pure lines', or constant varieties, of crops. It has been the experience of generations of plant breeders that nature cannot be overcome by nurture and that the intractability of living matter is an obstacle to the rapid improvement of crops. The great Soviet geneticists have been content to work patiently within the framework of classical genetics; but Lysenko was impatient with this restriction. The disciple of Lysenko cannot resign himself to the stability of nature. Nurture must take charge over nature, at any rate within the boundaries of the Soviet Union: for it is a principle of dialectical materialism that it should be so.

The second approved authority on genetics is Darwin, who believed that nature was not fixed, but was continually undergoing small variations. Darwin's writings have

[1] *Ibid.*, p. 23. They refer in particular to the writing of Lysenko and his colleague Prezent.

(in the words of Hudson and Richens) been erected ' to the status of a canon '. By Darwinism we in Britain and Lysenko in Russia mean quite different things. We retain those parts of Darwin's work which have withstood eighty years of criticism, and we forget the rest. But for the disciples of the ' new genetics ' Darwin's work is sacrosanct. Even his most tentative views must be accepted as literal, true, and final, in the way that a Fundamentalist accepts the story of the Fall. From Darwin, therefore, Lysenko's school draws its view that variability in animals and plants depends on the conditions of life, and that by manipulating the environment it is possible to bring about appropriate variations in a crop; also its view that continued self-fertilisation in animals or plants is injurious.

The third authority is the famous Russian biologist Timiryazev (1843–1920), who was one of the few scientists of Tsarist times to side with Lenin in October 1917. He was critical of some of the early work on genetics and he was the great interpreter of Darwin to the Russian people. Other authorities are Michurin (1855–1935) and Burbank (1849–1926), who were both clever gardeners with no rigorous scientific training; the one in Russia and the other in the United States. They both ' had an eye ' for a good plant, and they achieved great success in producing new varieties. Their success was due to industry and practical enterprise and not to any scientific basis in the design of their experiments. Both America and the Soviet Union set store by practical results, so that in the eyes of simple people Michurin and Burbank became famous. As not infrequently happens in such cases, both Michurin and Burbank assumed that their fame would give authority to their opinions on subjects they knew nothing about; and they both made irresponsible pronouncements about the laws of inheritance and variation. Thus, as a pleasant relief from the complex and highly mathematical theories of variation which are studied by modern geneticists, Burbank says that variation occurs because " Mother Nature . . .

knew that sameness, monotony, exact reduplication over and over again would make this world the dullest point of light in the whole universe'.[1] And Michurin believed that the relative vigour of paternal and maternal parents determined their influence on their offspring. The writings of both Michurin and Burbank are part of the canon of authority for the 'new genetics'. From these authorities Lysenko's school draws its faith in the importance of the pragmatic test of utility, and its belief that the results of hybridisation depend as much on nurture, the 'conditions of life', as on the natures of the parents. Truth as revealed by these authorities is not a matter for debate, and if the results of experiments are inconsistent with the authorities, so much the worse for the experiments.

The battery of authorities is supported by a battery of heresies. Work may be condemned by Lysenko and his disciples, not on any intrinsic weakness it may have, but because it falls into one of several heresies. The chief heresies are: any sort of idealism founded on the work of Berkeley or Kant; any formalism founded on the work of Mendel or Weismann; any work done under the influence of capitalism (Lysenko's assistant, Prezent, talks about 'the enormous social-class significance of our controversy'); any work tainted with 'theism' (that Mendel was a priest is sufficient to discredit his experiments); 'fascism', (*i.e.*, any theory which presupposes an innate heterogeneity of people or plants is fascist); and finally 'abiologism', which is the application to biology of inappropriate techniques, such as mathematics. When it was demonstrated that the work of one of Lysenko's students was statistically inconclusive, Lysenko's retort was 'we biologists do not want to submit to blind chance . . . we maintain that biological regularities do not resemble mathematical laws'. And as to the familiar results of breeding experiments, when characters such as flower colour appear in the offspring in the ratio three to one, Lysenko asks rhetorically,

[1] Quoted by Hudson and Richens, *loc. cit.*, p. 13.

'Is it possible to squeeze into the dry, narrow, scheme of three to one all the variety of living Nature? Unfortunately Morganistic geneticists not only attempted to accomplish this . . . but quite firmly implanted this belief . . . into the heads of agronomists in general'.[1] Lysenko's explanation of the irrefutable segregation of characters in breeding, as given at a lecture in Moscow in 1945, was that such characters of the parents as are not assimilated into the offspring are 'belched out' in the next generation.

The argument by heresy-hunt was used with deadly effect against the most outspoken and devastating critic of Lysenko, the famous Russian biologist N. I. Vavilov. Vavilov probably went beyond safe limits in condemning the new genetics as an outbreak of medieval obscurantism. He paid a high price. He was accused of dilatoriness in getting practical results, of lending support to fascists by his theory of centres of origin of crops, and of aligning himself with Bateson, the leader of genetics in England. In 1940 he was deprived of his directorship of the Institute of Plant Industry. He was subsequently imprisoned and he died, without any announcement or explanation, probably in 1943. The type of argument used against Vavilov is well illustrated by a comment made to me by a prominent animal physiologist in Moscow in October 1945. 'I reject Vavilov's views', he said, 'because Vavilov believed in Bateson, and Timiryazev condemned Bateson.' The same argument has been put on paper by Prezent.[2]

Appeal to authority and indictment of heresy: these are two of the techniques of the 'new genetics'. A third is to discredit the work of an opponent by innuendoes about his motives. Vavilov, it was said, falsified his results on flax in order to embarrass the 'new genetics', and Zhebrak takes cover behind a barrage of Latin and Greek technical terms. This technique was recently exercised against the excellent work of Zhebrak and Sacharov, who have suc-

[1] *Agrobiologia*. Solkhozgiz, 1943, p. 137.
[2] *Yarovizatsia*, 1939, pp. 87–116.

ceeded in ' remodelling ' wheat and buckwheat by treating plants with colchicine and breeding varieties with double the normal number of chromosomes in their cells. These accomplishments were difficult to discredit, because they passed the test of utility: they did in fact produce new crops with higher yields than the old. Lysenko's comment is as follows: ' Mendelian geneticists who maim plants by the application of poisons and other extreme treatments maintain that they are working out a method for producing fertility in sterile distant hybrids. The crossing of distant species, and the production from the crosses of fertile offspring, should be studied in the works of I. V. Michurin.' [1]

Finally, there is the appeal to practical utility, an appeal which has great weight in the Soviet Union. It must not be overlooked that wrong means do occasionally lead to right ends, and even by chance, truth might lie at the end of a spurious argument. What, then, has the new genetics actually accomplished by way of experiment? And are its accomplishments due to the application of dialectical materialism? To answer these questions, I shall describe the two experiments upon which Lysenko bases his principal claims, both of which I saw for myself in Moscow.

In the first experiment individual plants within what is said to be a ' pure line ' of wheat are pollinated with mixtures of pollen from the same ' pure line ' and it is found that the offspring from these hybridisations are earlier, and give higher yields, than either parent. This vigour after hybridisation is a familiar experience, but it follows only when the parent plants are different in their hereditary make-up, and never when the parent plants are from a population almost homogeneous in its hereditary make-up, as a ' pure line ' is supposed to be. Lysenko's results, if they were convincing, would prove that the ' nature ' of varieties can be changed by the rejuvenating effect of cross-pollination. They would destroy the anti-dialectical concept of immutability, and they would provide a quick

[1] *Yarovizatsia*, Vol. 3, 1939, p. 19.

and easy means of raising crop yields on collective farms. Lysenko claims to have established these three points. But if the data will not stand the test of statistical analysis, and if the so-called 'pure lines' are not pure lines, but are very heterogeneous, then Lysenko's experiments prove nothing at all; and that is how the work appears to an outside observer.

The second experiment concerns the transmission of heredity through grafts, and is based on the claims of Michurin. A variety of tomato which bears round, yellow-skinned fruit is grafted on to a variety which bears pear-shaped, red fruit. The scion might be expected to bear round yellow fruit, unaffected by the stock; and it is a common experience that *seeds* from such a scion as this grow into plants which show no influence of the stock on which the seeds were borne. In brief, the heredity of a stock is not transmitted through a graft to enter seeds borne on the scion. A disease, such as virus, may be so transmitted. So may a chemical substance: for instance tomato seeds from grafts of tomato on tobacco may contain nicotine. But the material of heredity is not carried that way, according to our present knowledge.

Now Lysenko makes the striking claim that the stuff of heredity is carried into the seeds on the scion; so that in the next generation, these seeds do not give only round yellow fruits, but red fruit, pink fruit, mottled fruit, fruit with a 'beak' at the tip, and so on. If this claim were correct, it would cause a revolution in genetical theory and in the practice of plant breeding. One would expect, therefore, Lysenko's claim to be supported by exhaustive and convincing experiments, carried out with pedigree plants free from disease. In actual fact the experiments were carried out with plants of no certain pedigree, some of which carried the virus disease spotted wilt, which produces a red-yellow mottling of the fruit. Furthermore the numbers of plants used were far too small to establish any such striking claim.

In experimental biology the only satisfactory test of a claim is that the crucial experiments can be repeated by other workers. Lysenko complains that his opponents will not take the trouble to repeat his experiments. There is some substance in this complaint, but some workers have tried, and have failed, to reproduce Lysenko's results. When, however, other workers are unsuccessful in modifying heredity by grafting, or in increasing yields by mass-pollination within a variety, Lysenko simply replies by asserting that they are bourgeois-Mendelians or they have not reproduced the 'right' conditions. Since Lysenko does not specify what the 'right' conditions are, the controversy has to be dropped at that point. The only reasonable conclusion a biologist can reach about Lysenko's experiments is that they have so far proved nothing, and the results do not point to any useful application of dialectical materialism to genetics.

In a country as great as Russia, with such an impressive body of first-class scientists, who are familiar with science in the rest of the world and are contributing substantially to it, the 'new genetics' is a strange anomaly. It is well past its zenith but it still flourishes in uneasy truce beside the 'old genetics'. Lysenko and his school are clearly a deep embarrassment to *bona-fide* biologists; yet the school goes on, and Lysenko was made a Hero of Socialist Labour, the Soviet equivalent of an Order of Merit, in June 1945. How can the Academy tolerate such a departure from its catholic standards? And how can Lysenko pose as leader of genetics when he is patently unfamiliar with most of the advances in the subject over the last twenty-five years?

I think that the answer to both these questions is in the psychological condition of modern Russia. Russians are religious: and the State has had to substitute a powerful optimistic faith in place of the church. Russians are theorists and dreamers: and the State has had to discourage theories and dreams unless they led to practical results. The Russian peasant still rules Russia; if he

withholds grain the State might collapse: therefore the State has mobilised the peasant under the banner of scientific agriculture, and the agronomist on each farm is as much concerned with people as with crops. For her optimistic faith Russia has chosen dialectical materialism, and her problem is to make it an everyday religion. For this she needs prophets. Lysenko is an excellent prophet. He is full of the unquenchable optimism, the impatience with inactivity, the scorn of the word ' impossible ', which Russia must have to complete her social experiment. He is a peasant who understands peasants. He is a shrewd and clever practical agriculturist. When potatoes ran short during the war, he led the campaign to cut up tubers into small pieces and sow them separately. His campaign was successful. When potato yields were too low in the Ukraine, he suggested that tubers should be sown in summer instead of spring; a device already practised in other parts of the world: and it worked. When he saw the thin layers of snow being driven by winds off the fields in Siberia, he shocked convention by announcing that wheat should be sown in stubble. Again it worked. When the much-advertised pre-treatment of grain by low temperatures, called vernalisation, proved a great failure, Lysenko cleverly substituted another pre-treatment, which is virtually a germination test, but which appeared under his name in the decrees for the Spring sowing in 1945 and 1946. He is the peasants' demagogue. What he says to them, goes. And he epitomises dialectical materialism in action; he provides the practical philosophy for the collective farm. If the Bolsheviks had not believed that man can remake his crops, his beasts, and even himself, they would not be where they are today. The missionaries of this faith have to be less sophisticated than the average polished and well-educated Academician. That, in my opinion, is one reason why Lysenko and his school are quietly tolerated.

Another reason is that the State, while honouring her thinkers and dreamers, knows that they cannot cure the

Russian people of their congenital inactivity. If a tenth of the plans made by the Soviet people had been carried out, Russia would be the Utopia the Dean of Canterbury thinks it is. But the bridge between planning and accomplishment cannot be crossed without a hard-headed insistence on practical results, and this attitude is foreign to the Russian character. Therefore the new Russia has needed men who rate utility as the highest test of a theory. Genetics is a notoriously useless subject; Lysenko was not far wrong when he said it had contributed practically nothing to agriculture. Soviet genetics should be utilitarian: Lysenko regards it as his business to make it so. 'There is no fortress', said Stalin, 'that bolsheviks cannot take by storm.' This slogan is applied to the Arctic and to the deserts; it must be applied also to the unexplored regions of science and agriculture: that is Lysenko's belief. It is a belief which is very valuable for the rebuilding of Russia. The fact that it is a point of view inapplicable to genetics without distorting the truth is, from the political angle, neither here nor there. That, in my opinion, is another reason why Lysenko and his school are quietly tolerated.

And what of Lysenko the man? Can we, Russian fashion, analyse his motives as he so often analyses those of his opponents? He is not a charlatan. He is not a showman. He is not personally ambitious. He is extremely nervous and conveys the impression of being unhappy, unsure of himself, shy, and forced into the rôle of leader by a fire within him. He believes passionately in his own theories, and he is not convinced by cold reasoning. He describes his own writing as always impartial, although passionate, and the writing of his opponents as 'passionless, cold-blooded and measured, yet extremely partial'. He identifies his work with the welfare of Soviet agriculture, so that any attack on him he interprets as an attack on the Soviet state. He is fired by his mission to scourge bourgeois genetics out of Russia, because he really believes it is harm

ful. He was aptly described to me by one who knew him well as 'like Savonarola'. The 'new genetics' is an interesting example of the grave danger of departing from the familiar methodology of science, and approaching natural phenomena with the mind already made up. Just as Krenke's work is a legitimate and profitable use of dialectics in science, so Lysenko's work is an exploitation of dialectics in science for political ends. The ends may be justified; Lysenko may be doing a great job for Russia. But the bulk of his opinions on genetics may be dismissed as the products of a medieval mind using what is almost a medieval technique.

Arctic Agriculture and Exploration

The theme of this chapter is the influence of Marxian philosophy on scientific research. A study of contemporary science in Russia justifies the conclusion that most scientific research in the U.S.S.R. bears no sign of Marxian influence, although a little of it is either inspired by dialectics or clothed afterwards in a dress of dialectics. This procedure led Krenke to generalisations which seem far-reaching and certainly merit serious attention; it led Lysenko to the most virulent outbreak of obscurantism in science since the Middle Ages.

It is appropriate to include here a somewhat different effect of Marxian philosophy on science. The idea of 'struggle' (*borba*), which permeates the writings of Lenin and Stalin, has flowed into the remotest channels of Soviet social life. We read of struggle against drought, struggle against beetles, struggle for the harvest, and so on. 'There is no conception more fundamental to Soviet Communism', say the Webbs, 'than that of man's perpetual struggle towards a greater command of the universe in which he finds himself.' And with the idea of struggle goes a reckless optimism, a bravado almost, in large-scale technical research and in far-distant exploration. The plant-breeder

is not merely working at plant selection: he is 'remodelling' crops for socialist agriculture. The agronomist is 'liquidating' low yields. The explorer is 'conquering' the desert. The 'struggle against the Arctic' is a striking example of enthusiastic team-work for the 'mastery of Nature', and it calls for special comment.

About a third of the Soviet Union lies within the zone of the Soviet Arctic,[1] and most of her great rivers flow into the Polar Sea. It is not surprising, therefore, that the conquest of the Arctic has caught the public imagination in Russia. To be a scientist or a sailor or an explorer in the Arctic is the ambition of many young Russians. Propaganda about Soviet activities in the Arctic is maintained in the press all the time. The polar night has begun, said one newspaper in early December; 'yet the Soviet Far North is far from dormant. It is very much alive in spite of the double burden of sub-zero weather and unremitting night that Nature has laid on it.' In a book *Forty Thousand Against the Arctic*, Smolka has written an account in English of the Soviet Arctic. His comments on Arctic agriculture are ecstatic rather than penetrating, but he does convey well the exuberant enthusiasm in this peaceful war against frozen soil, drifting ice, and paralysing dark winters. The Soviet philosopher will tell you that this enthusiasm is Marxism in practice—the application of dialectics to the mastery of man over his environment. For this reason an account of it has a place in this chapter.

The Soviet Government realises that the conquest of the Arctic requires brain as well as brawn, and there is accordingly a vigorous Arctic research programme. Research work falls under one or other of four principal controls—Agriculture, under the Ministry of Agriculture; surveys, particularly in mineralogy, soil science, and archaeology,

[1] This zone is not delimited by latitude 66° 30′, but across most of Russia lies somewhat below it. The delimitation and administration of the zone is described by T. A. Taracouzio in *Soviets in the Arctic*, New York, 1938.

under the Academy of Science; meteorology, oceanography, and the study of magnetic phenomena, under the Arctic Scientific Research Institute which is attached to the Glavsevmorput (Northern Sea Route Administration); and mining, under one or other of the industrial Commissariats.

The Scientific Research Institute of Polar Agriculture has its headquarters in Leningrad. Under its young director, A. A. Kalnibolotsky, the Institute is carrying agriculture to the Soviet Arctic with missionary zeal. There is a staff of twenty-five scientific workers. They unfold for the visitor an immense map of Russia on which the Soviet Arctic is coloured red. This is the zone which Comrade Stalin has ordered them to make self-sufficient for grain crops, potatoes, and vegetables. The zone carries a population of about two million people. The soils are acid and sterile. The frost-free period may not be more than seventy-five days. The rainfall in many parts is low, and there are droughts in early summer. In the Ob Valley there is no regular course of the stream, and crops have to be grown wherever floods have deposited the rich silt. Every year the crops must be pushed further north and the people must be one step closer to supporting themselves.

To carry out its programme the Institute has seventeen experiment stations, from Murmansk in the west to Anadyr on the Pacific coast. It claims that wheat is grown at a latitude of 63° N., and oats, potatoes, and cabbages at 68° N. It boasts of tomatoes in Igarka and mahorka tobacco along the Ob. It reports yields of potatoes as high as fourteen tons per acre.

The high yields should not be taken seriously, for the Russians have a custom of calculating yields per acre from the yields on plots four metres square, or even from the yields of single plants; in fact potatoes on the Kola peninsula (varieties Vermont, Snowflake, and Imandra) yield about two-and-a-half tons per acre. Nor should the production of Arctic tomatoes be taken seriously, because, given a glasshouse with artificial heat and artificial light,

there is nothing more remarkable in producing tomatoes in Igarka than ice-cream from a refrigerator in Singapore. But, discounting these extravagances, one can find nothing but praise for the work of the Institute. It has made a systematic study of the Arctic soils and the manuring they require. It has opened up great stretches of country for agriculture and for stock-raising. It has found varieties of crops adapted to the very short growth seasons. It has studied methods of cultivation suitable for the ice-bound earth. It has prepared composts which bring into the soil suitable bacteria to promote fertility.

It is incorrect to imagine that these efforts have transformed the Soviet Arctic. The traveller through the Kola peninsula and around the White Sea, which is the mildest and most densely populated part of the Arctic, sees very little cultivation and no novel kind of agriculture. There are potatoes in allotments round every village. There is a little haymaking in sheltered places among the birch and pine scrub. There are patches of oats along the roadside, but these seem to be more a gesture of optimism than anything else, for one observer told me in Murmansk that he did not remember the grain ripening in any season during his stay of three years in that district. There are good cabbages and radishes. And near settled areas, there are extensive glasshouses where other crops and even flowers are grown.

Owing to the poverty of the soil, it requires a great deal of manure to grow a crop in the Arctic. The Institute reports that on some soils anything up to forty tons of manure per acre are needed to produce a crop of potatoes. Most of this has to be brought by rail or ship to the Arctic. When I asked one Soviet official whether it would not be cheaper and more convenient to bring the potatoes into the Arctic rather than the manure, he replied: 'Yes, of course it would. But that is not our policy.' To carry out this policy, a great deal of trouble is taken. Potatoes, for instance, are exposed to light under glass for forty-five days

before planting. They are planted at the end of May. Cabbages are raised in heated glasshouses in pots made of peat, and subsequently planted out. The Soviet Arctic is to be self-sufficient even for seed, and at every experiment station glasshouse space is provided for growing crops for seed production.

Arctic agriculture is an ideal; uneconomic, difficult, and of doubtful political value. But it does exemplify Man's struggle against Nature, and it is cementing the dozens of nationalities and tribes scattered over northern Russia into one nation. 'The Soviet Arctic', as one Soviet newspaper put it, 'has grown up to husky adolescence in the course of the last decade.' As one listens to the talk of the men who are carrying agriculture into the Arctic one is reminded of Kipling's stories of engineers in India. There is the same naïve and optimistic spirit of empire-building.

The development of the Soviet Arctic is not just an academic exercise in the struggle against Nature. It will never become a granary for Russia, but it is already a rich source of minerals and coal. Deposits of oil, nickel, lead, zinc, copper and manganese, are being mined on a large scale, and at Vorkuta on the sixty-eighth parallel, there are coal-mines which rival those in the Donbas. They are said to contain 120,000 million tons of coal. The opening up of these deposits followed a series of mineral surveys organised by the Academy of Sciences. One of these surveys, carried out during the war, had no less than seventy specialists attached to it.

The activity in the Soviet Arctic which excites the greatest enthusiasm is exploration. The Russians have developed a precarious sea route from the Atlantic to the Pacific. It is under the control of the Northern Sea Route Administration, founded in 1932. This Administration manages not only trade and navigation: it has attached to it the All-Union Arctic Scientific Research Institute which is run by a team of irrepressible young scientists, under the direction of V. K. Buinitsky. This Institute takes as its

province all the land and seas in a sector from 32° east to 168° west and up to the North Pole, with the exception of the Spitsbergen archipelago. It has eighty-six stations in this area, one of them on Franz Joseph Land on the eightieth parallel. The stations are manned by geophysicists, meteorologists, hydrologists, radio operators, and cooks. They are brought to and from their stations by planes or ships. They settle down for their term of duty with stores of food and even live pigs and chickens. Their work is to aid navigation in every way, to provide weather reports, to follow the course of drifting ice, and to make geophysical observations. They set up 'weather robots' which send automatic radio messages of weather conditions. They have a fleet of reconnaissance 'planes for tracking the movements of pack ice. And in 1945 they sent out three expeditions: One to study the oceanography of the East Siberian Sea, another to study weather in the Chukhotsk Sea, and a third to study the early Russian encampments on the Taimyr peninsula.

It is their proud boast that Arctic exploration was inspired by Stalin himself, and they embark with zest on the most ambitious and hazardous undertakings. The most spectacular of these was the famous drifting ice expedition of 1937, when four Soviet explorers were landed by plane at the North Pole. They set up a scientific station, and remained on the ice floe for 274 days, during which time it cracked up and drifted 1,550 miles. The leader of the expedition was Vice-Admiral Ivan Papanin, twice decorated Hero of the Soviet Union, a tough, jolly little man, who is the embodiment of the New Russia, and who goes into every new adventure with the gusto of a schoolboy. The official diaries of the expedition illustrate the Soviet philosophy of exploration so well that a précis of them is not out of place here.

On 21 May 1937, an aeroplane carrying Papanin and his three companions landed on an ice-floe at the North Pole. They unloaded tents, a radio set, meteorological instruments,

sounding lines and dredges, and all the paraphernalia of a scientific laboratory. Another plane came a few days later with stores, electric generators, and more equipment. The planes flew off and left the party of four to spend nine months on the floating ice-floe at the North Pole.

The party began a series of unique scientific observations. They secured complete data on the weather and on magnetic behaviour at the Pole. They took soundings and measured currents in the sea. Under the ice they found living things: minute seaweeds, jelly fish, and other sea animals. They found a warm stratum of water at a depth of 1,000 to 2,000 feet below sea level at the Pole. They lost a good deal of the fresh food they brought, because they buried their meat in the ice and the sun's rays penetrated the ice and warmed up the dark-coloured meat, which promptly went bad and had to be given to Vesyoly, the dog. The sun melted the surface of the ice-floe and made work with delicate instruments uncomfortable. As winter came on the puddles froze and the party built themselves a kitchen and a laboratory out of snow. The rooms were fitted with primus stoves and electric light. The colder weather brought new difficulties. One of the party, Fedorov, was making measurements of gravitation, using a pendulum; but the pendulum froze up. September brought clouds and snowdrifts. At the beginning of November it became completely dark. On 7 November the explorers celebrated the twentieth anniversary of the Great October Socialist Revolution with a special meal and a hot bath. They were not cut off from Russia. They heard by radio the celebrations in the Red Square. They received messages of congratulation from their Government and the Russian people. They were embarrassed (as one of them wrote in his diary) ' by the great love which the whole country felt for us '.

Later in November the explorers celebrated their first six months at the North Pole by receiving a flood of congratulatory messages and a special broadcast from Moscow,

which included talks by their wives. In the following month all four of them were nominated, and immediately elected, as deputies to the Supreme Soviet.

Meanwhile the camp was buried to the roofs in snow, and the ice-floe was drifting south. In six days it drifted 120 miles south-south-west: twenty miles a day from the Pole. Then the ice-floe began to crack. The cracks ran across the camp and at one time threatened to separate the radio station from the aerials. The party had an anxious time shifting stores and equipment to keep everything on the same sheet of ice. There were incessant storms and fierce winds. In February the camp was attacked by three bears, which had to be shot, and the party subsequently suffered indigestion from bear meat. They say in their diary that as they drifted on the ice in the Arctic darkness they did not feel isolated from home, for they could still send radio messages to their wives and listen to the congratulations of the Russian people on their exploit.

On 14 February 1938 the party had instructions to prepare an aerodrome for the planes to come and take them home. The clouds were low and their camp was hard to find. A plane landed, but it had to be abandoned on the ice. A week later two ships, the 'Murman' and the 'Taimyr' came alongside the ice-floe to take them off, and the explorers broadcast their last radio message from the floating ice. Here is a translation of part of the message:

'Immensely glad to report fulfilment of the entrusted task. From the North Pole to 75° north we carried out completely all the planned explorations and collected valuable scientific material. . . . Since 1 February, when our ice-field broke into pieces, we continued all observations possible in these conditions. Worked confidently. Did not worry at all about our fate. Knew that our powerful motherland, having sent her sons, would never abandon them.

'Care and attention of our Communist Party, Government, beloved Comrade Stalin, and all Soviet people

supported us all the time and helped to carry out successfully the whole work. At this hour we are leaving the floe . . . having covered during 274 days of the drift over 2,500 kilometres. . . . The Red Flag is flying on over the vast icefields. Signed Papanin, Krenkel, Shirshov, Fedorov.'

This is the spirit in which Marxian philosophy is applied in modern Russia.

Chapter 6

SCIENCE ON SHOW

THE JUBILEE CELEBRATIONS OF THE 220TH ANNIVERSARY OF THE ACADEMY OF SCIENCES OF THE U.S.S.R.

In April 1945 there were rumours that the Academy of Sciences would hold a jubilee celebration to mark its 220th Anniversary. The first suggestion was that the celebration should be held in May, to coincide with the fiftieth anniversary of the invention of radio by A. S. Popov.[1] Later on the date for the celebrations was postponed to 15 June. Even up to the last week of May Academicians of high standing did not know exactly when the celebrations would begin or what foreigners would be invited. Nevertheless laboratories of the Academy were feverishly preparing for the celebrations. Most of these laboratories had recently returned from evacuation to Middle Asia or the Urals, and had scarcely settled down to work again. The office of the Praesidium was under scaffolding and closed to visitors. The biological institute was being painted and was not to be on view till early June. The President's house was swarming with painters and plasterers. In the Soviet scientific world there was suppressed excitement. Nobody knew exactly what was coming.

Early in June the newspapers spread the excitement to the public. Every day the press had something to say about the Academy of Sciences. *Izvestiya* of 8 June carried an article about the work in Kapitsa's Institute of Physical Problems. On 9 June *Trud* announced that 500 exhibits, illustrating the history of science in Russia, would be on view in Leningrad. *Izvestiya* of 10 June had a message of greeting to the Academy, signed by Einstein and others, from the Independent Citizens Committee of Science and Art Workers in the U.S.A. On 11 June the

[1] See Chapter 8.

Academy was front-page news in every Moscow paper. It was announced that the rare and coveted status of Hero of Socialist Labour together with the Order of Lenin, and the Gold Medal 'Serp i Molot' (Sickle and Hammer), were awarded to thirteen Academicians; and 168 scientists received other decorations. Three out of the four pages of *Pravda* were devoted to the Academy. The leading article was entitled 'Festival of Soviet Science'. The President of the Academy, V. L. Komarov, wrote six half columns on 'Science and Work'. An interview with the eighty-nine-year-old Academician Bach appeared under the title 'Soviet Scientists are carrying on their Patriotic Duty with Honour'. On 12 June the chorus of congratulation to Soviet science became even louder. The President of the Academy published an article in *Izvestiya* entitled 'Glorify our Motherland by new Scientific Discoveries'. Photographs of Komarov, Prianishnikov, and other veteran scientists appeared in many papers and eminent Soviet savants gave press interviews. On 13 June the newspapers at last came out with some hint of the programme, and *Pravda* carried a leader entitled 'On the Eve of the Jubilee Session of the Academy of Sciences'. Simultaneously the guests began to arrive.

Altogether about 1,000 delegates attended the celebrations: 145 Academicians, 201 corresponding members, about 122 foreign scientists, and the balance, other Soviet scholars. Attendance was by invitation only. Most of the Russian delegates were in Moscow by 13 June, and on 14 June the foreign guests (some of them having been given no more than forty-eight hours' warning of the invitation) began to arrive. The three Canadians came via Alaska and Siberia in a Soviet plane. The Americans came via the Atlantic and Teheran. Two Soviet planes brought the British delegation via Hamburg.[1] Other Soviet planes

[1] At the last moment Mr. Churchill refused to allow eight members of the British delegation to attend. He explained that at the present stage of the war against Japan these eight were needed in Britain.

brought delegates from Teheran, Budapest, Warsaw, Paris, Stockholm. On 15 June 122 somewhat bewildered delegates from eighteen foreign countries [1] found themselves in Moscow; and the Celebrations began, just about a month after the Russians had entered Berlin.

Every delegate was given an elegant metal medallion to wear, cast at the Soviet mint; a handbook of the Academy of Sciences, with photographs of Lenin and Stalin and the principal institutes of the Academy; histories, in any of three languages, of the several branches of the Academy; a programme, embellished with gold; and tickets for receptions and theatres. At the same time special postage stamps were issued to commemorate the anniversary. The famous columnist Ehrenburg reminded the British and Americans how much they owed to Russia. 'What would have happened', he said, 'to the land of Shakespeare and distant America if the Red Army had not fought the Hitlerites for three years?' [2] The President of the Academy produced yet another stirring article entitled 'A remarkable Jubilee' in which he praised Stalin for his encouragement of science, and the *Pravda* leader for 16 June, under the headline 'Great Triumph of Soviet Culture', greeted Lenin and Stalin as 'the great Kings of Soviet Science'.

The Celebrations were formally opened by a reception held in two shifts at the Praesidium of the Academy. It was a colourful gathering. The Russians, whether in uniform or civilian clothes, wore their medals. The British delegation outshone the Russians by appearing (much to the amusement of Moscow) in full academic robes. It was an impressive meeting. Men who had read one another's work for years here met for the first time. Nobel prizewinners from four different countries

This incident disappointed the Russians, but it was merely reported without comment in the Soviet press of 16 June.

[1] Great Britain, Canada, Australia, U.S.A., Finland, Belgium, Mongolia, Iran, Rumania, Hungary, Bulgaria, Yugo-Slavia, France, Czechoslovakia, Poland, Sweden, China, India.

[2] *Pravda*, 16.6.45.

were present: Szent-Györgyi from Hungary, Curie-Joliot from France, Langmuir from America, and Adrian from England. Gossip writers pushed their way through the crowds, and photographers made snapshots of the great in intimate conversation. We read next day how Hinshelwood and Semenov, both authorities on chain reactions, met for the first time; how a group of Mexicans, Poles, and Canadians together congratulated the President on his anniversary; and how Kapitsa answered questions about his work 'surrounded by a dense circle of English scientists'.[1] Despite its formal setting, the reception was really enjoyable. Here, one felt, the flow of scientific thought between nations, dried up by the war, was beginning to trickle again. In these rooms one was witnessing the revival of intellectual life in Europe.

On the following day at 1 p.m., the sessions opened with a meeting in the Bolshoi Theatre. The theatre was full. The Diplomatic Corps occupied the boxes on one side. Beirut, President of the Polish Republic, was present. Delegates occupied the floor of the theatre, and the six circles were full of scientific workers, the press, and other visitors. A large orchestra was playing. When all were assembled the music stopped and the curtains of the great Bolshoi stage parted to reveal, brilliantly lit by footlights, an impressive and unusual spectacle.

At the front, behind a long table covered with red cloth, sat the Council of the Academy of Sciences. They were backed by ranks of other distinguished scholars. The impressive depth of the Bolshoi stage was occupied by a huge bank of hydrangeas. Among the heaped flowers stood a bust of Lenin, three times life size; behind Lenin, in a setting of red curtains, hung a picture about twelve feet high by eight feet wide of Stalin in the uniform of a Marshal.

The President of the Academy, Komarov, declared the session open. At the mention of Stalin's name the audience

[1] *Vech. Mos.*, 16.6.45.

rose to its feet and clapped for some minutes. Then followed three long addresses, by Komarov, Bruevich (Secretary of the Academy) and Obruchev (a renowned geologist, eighty-two years of age). Komarov was too frail to read his own speech, but there was nothing frail about the speech itself. He traced the Academy through three phases: the encyclopaedic phase, under the influence of Lomonosov; the 'positive' phase, under the influence of Mendeleev and other nineteenth-century scholars; and the present phase when 'the tools of industry, social forms, and even nature herself, are remodelled on the principles of Reason and Science'. 'It is the special pride of the Academy', he said 'to count among its honorary members Joseph Stalin.' Komarov pointed out that the main reason for the success of the Academy lay in the Soviet system of government. He drew attention to the traditions of freedom and democracy in British and American science. He concluded with the following stirring words, which were received with applause:—

'The leader of our country is a man of genius and a great scientist. He surrounds the work of our Academy and its students with his exceptional attention. Eminent scholars are honoured by the Government . . . and enjoy nation-wide recognition and regard. . . . Long live the great Soviet Nation! Long live the progressive Soviet Science! Long live Stalin!' [1]

The speeches were punctuated with messages of greeting: from the Academy to Stalin; from the Academy to Molotov; from the Academy to the Red Army and Fleet; from the Council of People's Commissars and the Central Committee of the Party to the Academy; from the Central Komsomol Committee to the Academy, and so on: all in the same heroic style. Particularly heroic was the reference to Lenin in one message of greeting as 'the greatest genius of our epoch, that coryphaeus of progressive scientific thought, the founder of our Soviet state'.[2] All the time a

[1] English version from *Moscow News*, 20.6.45. [2] *Ibid.*, 20.6.45.

platoon of photographers walked about the theatre, with movie and microfilm cameras. As soon as they had set their instruments up against a target in the audience or on the platform, the great spotlights of the theatre, accustomed to following ballerinas across the stage, swung on to the victims, who blinked uncomfortably in the glare until the 'shot' was taken. For nearly three hours the speeches dragged on, with occasional pauses when a neatly dressed maid brought a glass of tea up to the speaker's rostrum. The diplomatic boxes emptied out. The delegates read newspapers or chatted quietly together. Even some members of the Praesidium settled down to read pamphlets, and it was already after 4 o'clock when the audience was revived by a brisk performance of Tchaikovsky's '1812' Overture, and the delegates went back to their hotel to dress for dinner.

In the evening the celebrations warmed up. A prodigious dinner was given at the Government's expense to more than 1,000 guests in the Moscow Hotel. The dinner began at 7 p.m. and was still going at midnight. The 'zakuska' alone comprised no less than seventeen items: caviare, sturgeon, raw salmon, chicken, ham, crab, salads. There was vodka, brandy, Georgian wines, champagne, and lemonade. A band played continuously. After nearly a couple of hours at the zakuska a seven-course dinner began. By this time many of the guests were walking about the hall toasting their friends, and by the time roast woodcock was served less than half the guests were in their places. There was no doubt about the sincerity of the Russians' welcome and their delight at having foreign scientists among them. Toasts were drunk to research on every subject from atomic structure to Australian desert plants, and in the narrow space in front of the band a distinguished British scientist was observed to perform, not without skill, a Russian folk dance. As the newspapers put it next morning: 'The dinner was held in a warm and friendly atmosphere.'

The next day was Sunday, 17 June. The foreign guests were treated to an uncommon privilege: they were given a conducted tour round part of the Kremlin. In recent years the treasures of the Kremlin have been seen by very few people—Russians or foreigners—and it was a sign of the high standing of the Academy that this visit was allowed. The Kremlin museums are packed with property formerly belonging to the Tsars: pearl-studded ikons, gold and silver plate, and quaint knick-knacks such as a small model train made in platinum, from the Imperial nursery. The Kremlin palaces are like most palaces, cold and draughty and smelling strongly of furniture polish (a commodity very hard to obtain in Russia). The Kremlin churches, now (1946) in course of restoration, are magnificent. And finally in the Kremlin there is the meeting-place of the Supreme Soviet, like a monster nonconformist chapel, where deputies from all over Russia meet occasionally, and the Praesidium occupies what correspond to choir stalls. The visiting scientists were shown in which oak pews the Belorussians sit, the Uzbeks, Georgians, Armenians, Karelians, and the rest; and the guide was disconcerted by a question from one of the British delegation: 'Where does the Opposition sit?'

In the evening there was a second instalment of the formal sessions of the Academy. This time the meeting was in the historic Hall of Columns, which was decorated with enormous portraits of Lenin and Stalin and inscriptions 'Long live the great invincible banner Marx–Engels–Lenin–Stalin! Long live Leninism!' This meeting began at 7 p.m. and lasted for four hours. There were three formal addresses: one by Zelinsky, the doyen of chemistry in Russia, and now in his eighty-fifth year; another by Delaunay, on Russian mathematics; and the third by Yurev, on aerodynamics. Most of the evening was devoted to the presentation of addresses of congratulation, of which there were no less than 300. Some of them were magnificent documents, handwritten on vellum with illuminated

letterheads and bound in morocco leather or fine wood with metal work and silver clasps. Among the messages read on this occasion were those from the Royal Society of London, the Paris Academy, the Scientific Societies of America, the scientific academies of Czechoslovakia, Yugoslavia, and Georgia, and the University of Cracow. One after another representatives mounted the rostrum, each clasping his folio volume, read its contents, bowed to the applause, and handed his address to the President. As at the first session, more and more empty seats appeared in the hall, and about 11 p.m. the meeting was closed and the survivors went home. Russians and foreigners alike realised that these formal sessions were a necessary introduction to the informal discussions they all wanted: so they sat them out patiently, even though the Russians could not hear, and the foreigners could neither hear nor understand, most of what went on.

On the following day, Monday, 18 June, the sectional meetings began; the chemists in one hall; the biologists in another, and so on. These meetings were scarcely less formal than the 'solemn' session in the Bolshoi Theatre. They opened at 11 a.m. and continued with one brief interval till 4 or 5 p.m. The time was occupied with addresses by the leaders of Soviet science, together with short speeches of greeting from foreign guests, all of which were reported in the press. On the platform at each meeting sat the Academicians for the appropriate section, in a setting of flowers, red drapery, and a bust of Lenin. At the Institute of History of the Academy of Sciences there was a symposium on Slavonic affairs. It was announced that the Academy's history of Bulgaria had already been published and that the Academy would shortly publish a two-volume history of Poland. Speeches by professors from Poland, Bulgaria, Czechoslovakia and Yugoslavia 'were listened to with great attention'. They all emphasised the desirability of fruitful co-operation between scientists of the Slav nations.

It was intended that the rest of the week should be occupied in visiting laboratories, but by 19 June the official programme showed signs of breaking down. Most of the delegates, particularly the foreign delegates, wanted to spend their time talking to specialists in their own subjects: a soil scientist (for instance) is not satisfied with one hurried visit to a soil institute; rather than visit other institutes he prefers to go back to the soil institute for two or three days running. The organisers of the Celebrations did not provide for this, and even added unexpected and important engagements at very short notice, to a programme which was already in chaos. There was rarely time for meals except breakfast and late supper, and very little time for sleep. Nevertheless the foreign delegates and Soviet scientists enjoyed themselves greatly. Both sides expressed delight at the cordial relations which had sprung up so spontaneously and quickly, and had surmounted the barriers of language and ideology. The only people who seemed anxious were the various 'shepherds' (ladies from the Institute of Languages) appointed to look after the foreign delegates. The British delegation good-humouredly christened one of their 'shepherds' with the nickname 'Worried Winnie', and went their ways leaving her to do her best to organise the more docile members of the delegation. She had little success. By the middle of the week the biochemists, the physiologists, the soil scientists, the chemists, the palaeontologists, had 'got together' and organised unofficial meetings for themselves. These meetings and the visits to laboratories were, by common consent, the most important and successful part of the celebrations. The leaders of laboratories had made the most thorough preparations for their visitors. Everything was clean and polished and in its right place. There were vases of flowers on the benches. The walls were lined with large graphs and diagrams, sometimes in English as well as Russian. The members of the staff stood at their places for days, to attend to visitors. Many of the scientific

workers had prepared and learnt by heart brief *résumés* of their research in English or French. Almost every institute has a good linguist, and he (or she) was in constant demand to help out colleagues whose knowledge of foreign languages was insufficient for a technical conversation. One cannot exaggerate the enthusiasm of Soviet scientists at having foreigners among them. There was no sign of the suspicion so commonly (and wrongly) attributed to Russian scholars. They spoke openly about unpublished work. They discussed plans for future research. Some of them were so anxious to give their results away that they copied out tables and sketched graphs to present to the guests.

On the evening of 18 June the Bolshoi Theatre was again taken over by the Academy—this time for a performance of Glinka's opera 'Ivan Susanin'. On the 19th there was a performance, for the delegates, of Tchehov's 'Three Sisters'. On the 20th, again in the Bolshoi Theatre, there was a performance of the ballet 'Giselle'. Delegates were everywhere most generously entertained and their engagements became double and treble-banked. On the morning of 20 June, for instance, agriculturists from five countries visited the Timiryazev Academy. They were welcomed by the director, Nemchinov, who outlined to them the history and organisation of the academy. Then they inspected the department of agrochemistry, guided by the veteran Academician Prianishnikov. The party had arranged to go on to another institute in the afternoon. But at about 3 p.m. they were brought back to the director's room to find a huge meal awaiting them: chickens, turkeys, salads, wines, vodka, and the rest; and they had to drink toasts for a couple of hours. After that they wrote their impressions, in a somewhat unsteady hand, in the visitors' book, and then resumed their inspection of the laboratories. At the point when their resistance was at its lowest, the foreign agriculturists were persuaded to cancel the next day's engagements and to come back to the Timiryazev

Academy. Similar happy dislocations of the programme were taking place in every other section.

On Friday, 22 June, according to the printed programme, the celebrations and the delegates were to move to Leningrad. But word had been passed round that the trip to Leningrad was postponed till the following Sunday. The reason for this was not announced: it was to enable the delegates to witness the Victory Parade, to be held (so it was rumoured) on 24 June. Accordingly, instead of the trip to Leningrad, there were two other excursions: one a boat trip up the Volga canal in the motor vessels 'Joseph Stalin' and 'Klim Voroshilov'; and the other a train trip to Tolstoy's country home, Yasnaya Polyana, under the guidance of Tolstoy's grand-daughter. Reporters travelled with the foreign delegates on each trip and recorded their small talk, which appeared in the next day's newspapers. On Saturday, 23 June, the delegates returned to Moscow to find three new engagements made for them for that day, and invitations from the Soviet Government to see the Victory Parade on the Red Square on the following day.

One of the fresh engagements was a reception by the Praesidium of the Academy, at which there were more speeches. Greetings were brought to the Academy by French, American, Indian, and Mongolian scientists, and from the filials of Kazakstan and Kirghizia. The most notable event was a speech in English by Kapitsa. It is common knowledge in Moscow that Kapitsa occupies a very privileged place in Soviet science. He is frequently consulted on matters of general policy and it is rumoured that, unlike all other scientists, he is immune from the tiresome business of submitting estimates for the expenses of his institute. It is probable that in this speech Kapitsa was the mouthpiece for Government policy. The following is a summary of what he said:—

> What will the consequences of this Conference be? The U.S.S.R. appreciates the achievements of British science. Our achievements

are not so great because we are younger. But there is really no such thing as Soviet science, or British science: there is only one science, devoted to the betterment of human welfare. Science must, therefore, be international. The U.S.S.R. has been the first to recognise this, by calling together scientists from all over the world immediately the war ended. The Soviet appreciation of international science is well illustrated by these celebrations. Foreign delegates have been brought here from their own countries by Soviet planes,[1] housed, fed, and transported by the Soviet Government. What other country is able to do this for international science? This is proof that the U.S.S.R. intends to take a leading part in international science.

We propose to stimulate international science after these celebrations in three ways: (i) By enlarging our scientific journals printed in Russian, English, and French; (ii) By publishing scientific monographs, provided they are good enough, in Russian, or English, or French; so that if you want your work published promptly you may let us have it for publication; [2] (iii) By arranging and taking part in more international congresses and by exchanging scientists between the U.S.S.R. and foreign countries.

Unfortunately there was no proper discussion after this important speech. The speech may be taken as a sincere gesture on the part of the Soviet Government that it will co-operate (provided it can do so on its own terms) in international scientific endeavour.

On the following day, Sunday, 24 June, the foreign delegates and other distinguished scientists had the privilege of witnessing, in pouring rain, the Victory Parade in the Red Square. And in the evening all the delegates, equipped with bulky food parcels, left in three special trains for Leningrad.

The trains had been specially prepared, and there were flowers in vases in the corridors. Early in the morning of 25 June the train stopped for twenty minutes at Lyuban, a town destroyed by the Germans. The inhabitants had been evacuated and were just returning to rebuild their

[1] Kapitsa did not mention the fact that foreign planes are not allowed to land on Soviet territory, except in most unusual circumstances.

[2] At present (1946) scientific publication in the U.S.S.R. is very seriously in arrears; and it is hard for some Soviet scientists to have their work published at all.

homes. The station was crowded, as stations always are in Russia, but the people had been told that a trainload of foreign scientists would pass through, and they were prepared with bouquets of flowers to give the guests. One wounded soldier, having located a member of the American delegation, presented him with an ash-tray made out of a German shell case, in gratitude for America's help to the Red Army. The first of the trains arrived in Leningrad about noon. There was a formal welcome on the platform, with more bouquets of flowers, and the President of the Academy, leaning on the arm of his wife, received an address of congratulation and recorded a brief broadcast.

All the delegates were delighted with their reception at Leningrad. Arrangements were more systematic than they had been in Moscow. In the hotel programmes were put up on a blackboard in Russian, French, and English. There were always enough cars or buses to take people from place to place. Every day some new gift appeared in the hotel bedrooms: cigarettes, with an embossed picture of the Academy on the box; a memorial volume to Leningrad's part in the war; a guide in Russian and English to the main buildings of Leningrad. The general course of events was as it had been in Moscow: solemn formal sessions at which numerous addresses of congratulation were read, while photographers took 'shots' from every angle; visits to institutes, including the famous observatory destroyed by the Germans, and to Pavlov's Institute in the sylvan surroundings of Koltushi; the ballet; a concert; and a banquet. On their arrival in Leningrad the delegates were taken to the 'Defence of Leningrad' museum, which is very impressive indeed, not only for the story it tells but also for the technique with which it is displayed. At the formal session in the hall of the Leningrad State Philharmonic, leaders of the Government and Army sat on the platform side by side with the Praesidium of the Academy. The magnificent crystal chandeliers were brilliantly illuminated. The background was hung with pleated red cloth,

and behind the President stood a bust of Stalin, some eighteen feet high. The proceedings opened with another rousing speech from the President, Komarov, which ended with these words, followed by enthusiastic applause:—'Long live Leningrad—the citadel of revolution . . . the city of progressive science! Long live . . . the great thinker and leader—Stalin!' After about three hours of speeches in this vein, the platform was cleared and the Leningrad symphony orchestra gave a concert.

On 27 June the Leningrad Soviet entertained the delegates to a banquet in the Uritsky palace. Over 1,000 guests were present. At one end of the hall there was a symphony orchestra. In a gallery off the hall was a military band. There were toasts, singers, solo-dancers, and items of music; and finally ballroom dancing until 1 a.m. On their way home from the festivities, two of the British guests had an agreeable experience. They were walking back to their hotel along the banks of the Neva. It was still light. A boy began to walk alongside of them. After a few moments, in very poor English, he asked them the time. This was simply the opening for conversation. He had been waiting outside the Uritsky palace for hours in the hope of meeting a real Englishman. With a little encouragement he shyly produced his English grammar book. He said he had reached Lesson 21. And by the Neva, in the pale light of a Leningrad summer night, at 1.30 in the morning, the boy and two British delegates went over Lesson 21 together.

Next day the delegates, deeply impressed with the generosity and enthusiasm of the people of Leningrad, departed in three special trains for Moscow. They were literally overburdened with hospitality. One zoologist had a crate of fossils. The botanists had ten-volume sets of the Flora of the U.S.S.R. and a score of other books. The physiologists staggered under a dozen monographs from two institutes. The only scarce commodities were paper and string for packing, but somehow everything was carried to the station and put on the train. Not only the

scientists, but the people of Leningrad, acted as hosts. One foreign delegate tried to give a tip to a maid at the hotel, who struggled downstairs with his books, and to the porter who put them on the train. Both refused—and tips are usually very welcome in the Soviet Union. The porter said in a surprised tone, 'But you are our guests here'.

The delegates arrived back in Moscow on Friday, 29 June. The celebrations had continued for fourteen days, and some of the foreigners were exhausted and anxious to return home; but they found awaiting them in Moscow a fresh crop of engagements. There was a rumour, no more, that some of the delegates might be entertained at the Kremlin on the following evening. It was therefore out of the question for them to be given a Soviet plane to return home before 1 July; and there was no other way to go home. On 29 June a grand concert was held at the Bolshoi Theatre, with no less than twenty-four items: orchestra, recitations of poetry, songs, piano solos, the State Dance Ensemble, and the famous Red Army Choir in songs and folk dances; almost as gargantuan as a Soviet banquet.

Saturday, 30 June, was spent in uneasy speculation. According to the programme, the celebrations were over; yet there was no opportunity for the delegates to go home. It was still possible that the delegates would be summoned to the Kremlin. The uncertainty lasted till about 4 o'clock in the afternoon, when it was announced that Generalissimo Stalin would entertain some of the delegates, and the members of the Academy, to a banquet that same evening at seven o'clock. Specially printed and numbered tickets, each inscribed with the name of the guest, were distributed at 5 p.m. At 6.30 p.m. the guests were driven in buses to the road leading into the Kremlin. There, notwithstanding the rain, the guests were disembarked to walk up the road and to pass through the gate. At the gate each guest was scrutinised by militiamen and the foreign guests were identified by one or other of the 'shepherds' who had accompanied them during the celebrations. At the gate

of the palace, and again at the top of the stairs, the guests and their tickets were scrutinised by other militiamen. Then the guests were allowed to proceed into the St. George's Hall, where the banquet was to be held.

There were several hundred guests. At one end of the hall there was a symphony orchestra (later to be replaced by choirs and dancers). At the other end there was a military band. The hall was lit by thousands of lights around the white walls, and by immense glass and silver chandeliers. The tables were loaded with wines, apples, cherries, salads, meats, fish, and caviare. Exactly at 7 p.m. Generalissimo Stalin walked in, followed by Molotov, Voroshilov, Kalinin, and other members of the Government. After prolonged clapping (in which Stalin himself joined heartily), Molotov announced that the Praesidium of the Academy were invited to sit at the Government table. The Praesidium accordingly moved up to vacant places near Stalin and his colleagues, and the dinner began.

The toasts followed almost immediately. Molotov announced that the reception had been arranged by the Government in honour of Soviet scientists and their foreign guests. Soviet citizens, he said, know of the great achievements of the Soviet State in improving the standard of life of the people. These successes were made possible by the revolutionary reorganisation of society on the basis of science, on the basis of scientific socialism, the greatest modern representatives of which were Lenin and Stalin. Loud applause followed this announcement, and a toast was offered to Soviet scientists. Then Molotov proposed a toast in honour of ' our foreign guests. . . . I drink to the health of our learned guests, to their future successes, and to the further development of collaboration between Soviet science and the science of other countries, in the interests of our peoples.' The third toast was to the Heroes of Socialist Labour. Speeches by eminent Academicians followed. The President of the Academy toasted Stalin ' our leader and teacher ' amid prolonged applause

in which Stalin himself joined. Then Kalinin and Molotov toasted each other. In between toasts there were musical performances by leading Soviet artists. The atmosphere was described by one of the newspapers as ' very joyful and moving,' but, in keeping with the august nature of the host, it was more subdued than other banquets had been. For one thing delegates were unable to drift amicably from table to table, for if they moved in the general direction of the Government table they found their way barred by muscular young guests seated at strategic places in the hall, and bearing an unmistakable resemblance to plain-clothes detectives. The banquet was a magnificent climax to the celebrations of the Academy, and it was impressive to hear, in one speech after another, how close are the bonds between science and government in the Soviet Union, and how generously the leaders of Russia regard scientific work. Exactly at 11 o'clock Stalin rose and walked out, followed by his Government. He did not speak at the banquet; but he obviously enjoyed himself; and his gesture to the Academy of Sciences made a very favourable impression. Before dawn next morning Soviet planes left Moscow with most of the foreign delegates, and many of the Academicians retired to their rest home at Uskoe.

The Celebration of the 220th Anniversary of the Academy was over, but its echo remained in the Soviet press for months. *Pravda* of 1 July carried another article from the fertile pen of V. L. Komarov, President of the Academy, entitled ' Triumph of Soviet Science '. He attributed the success of Soviet science to Stalin's constant care and encouragement, and he pointed out how the Soviet type of Government has advantages over all other forms. *Izvestiya* of the same date declared that ' Soviet science is a standard bearer of progress and civilisation '. A day later, in another Moscow newspaper,[1] the philosopher Academician Volgin published an article in which he praised the relation between Soviet science and public interests, and declared

[1] *Vech. Mos.*, 2.7.45.

that foreign scientists were greatly impressed by their visit; and he ended (somewhat inconsequentially) by saying that 'no one can question that the main part in the war was played by the Soviet Union'. Almost immediately, through the Soviet newsagency, Tass, in a dozen countries, came the comments of the foreign guests; and all of these comments duly appeared in the Soviet papers. A French delegate expressed his amazement at the creative spirit of the Soviet people.[1] Another French delegate said that French scientists could learn valuable lessons from the U.S.S.R.[2] The Swedish scientists declared in Stockholm that the Soviet Union does more for science than any other country in the world.[2] The Rumanian delegation held a press conference in Bucarest, in which it was stated that Soviet science was inspired by patriotism and was applied in the interests of society.[3] Tass at Helsinki reported praise of Soviet science from the Finnish delegates; and Tass at Ottawa reported the Canadian delegates as saying that Soviet science is on a higher level than science anywhere else in the world.[4] Tass from Warsaw spoke of the deep impression which the vast Soviet scientific organisation had made on the Polish delegates; and Tass from Budapest spoke of the Hungarians' astonishment at the links between theory and practice in the U.S.S.R.[5] From the U.S.A. it was reported that the American delegation considered two institutes in Moscow to be 'the most perfect in the world'; and one of the Americans is reported to have said modestly that 'in the majority of branches of science, the Soviet Union occupies first or second place in the world.'[6] Tass from Delhi and Tass from New York added their messages of praise from Indian and American delegates.[7, 8] A few days later the Yugoslavian guests informed Tass in Belgrade that the Soviet Academy of Sciences is the greatest

[1] *Vech. Mos.*, 2.7.45.
[2] *Pravda*, 5.7.45.
[3] *Ibid.*, 11.7.45.
[4] *Ibid.*, 11.7.45.
[5] *Red Star*, 13.7.45.
[6] *Pravda*, 16.7.45.
[7] *Ibid.*, 16.7.45.
[8] *Ibid.*, 18.7.45.

scientific centre in the world,[1] and simultaneously a report from one of the Canadians in the Toronto *Star* filled half a column in the Moscow press. 'The Soviet people', says the Canadian writer, 'has an almost religious worship for, and faith in science.'[2] The last few days of July saw in the Moscow press highly complimentary reports from delegates who had returned to Teheran,[3] to London (a report from the *Sunday Times*),[4] to Warsaw,[5] to Bucarest,[6] and to Washington,[7] and *The Times* special correspondent wrote that work in Soviet medical institutes 'was on a much higher level than anything similar in England.'[8]

Even by August the encomium had not died down. Tass from Brussels reported the happy impressions of the Belgian delegates,[9] and Tass from New York reported at length a meeting of the Soviet American Scientific Society; the report contained not only the familiar eulogy of Soviet science, but the statement by an American astronomer that the trial of sixteen Polish 'diversionists', which he had attended in Moscow, was 'the most open and just trial' he had ever attended.[10] The last echoes of the Celebrations reached the Moscow press in October, when Tass from Chungking reported the gratification of the Chinese delegate, who was very deeply impressed by all he saw in Russia.[11]

So the Celebrations ended, as was fitting, in a world-chorus of unanimous praise. Not quite unanimous; for one foreign guest was indiscreet enough to say in a press interview that he found a shortage of manufactured goods in the U.S.S.R., and that he took advantage of this by exchanging an old pair of trousers of his for 'two valuable tapestries of the seventeenth century'. This inglorious and improbable transaction was reported in the Canadian press, and apparently cabled to Moscow, for *Pravda* of 19 July devoted a special article to this guest and his

[1] *Pravda*, 20.7.45.
[2] *Izvestiya*, 20.7.45.
[3] *Vech. Mos.*, 21.7.45.
[4] *Izvestiya*, 24.7.45.
[5] *Ibid.*, 25.7.45.
[6] *Pravda*, 29.7.45.
[7] *Ibid.*, 30.7.45.
[8] *Izvestiya*, 25.7.45.
[9] *Ibid.*, 1.8.45.
[10] *Pravda*, 25.8.45.
[11] *Ibid.*, 24.10.45.

trousers, entitled 'The Breeches of Mr. X',[1] and beginning: 'A dung fly can leave its trace on a beautiful painting by Raphael. Mr. X, adjunct-professor from Y, decided to leave just such a trace on the work of the Jubilee session of the Academy of Sciences of the U.S.S.R.' In fairness to the Soviet press, and to Mr. X, it should be added that on two other occasions, *Pravda* quoted other comments of his on the celebrations, with evident approval. But *Pravda's* protest reveals a deep and powerful idiosyncrasy in the Russian character. Science had been on show. The show had been lavishly done and it had been generously applauded; but for Russians applause must be absolutely unanimous: otherwise the show is spoilt.

[1] *Pravda*, 19.7.45. The guest's name was, of course, printed, together with his university and his field of research; but it would be indelicate to perpetuate it in a book.

Chapter 7

THE RUSSIAN ATMOSPHERE

MURMANSK TRAIN JOURNEY; A FORMAL OCCASION — A SCIENTIST'S FUNERAL; AN INFORMAL OCCASION — CAR RIDE TO A COLLECTIVE FARM

BEFORE I went to Russia a wise acquaintance of mine in Cambridge told me that to understand Soviet science a man should study not only the work of Soviet scientists, but also Tolstoy, Turgeniev, Tchehov, Dostoyevsky, and Gogol. He was quite right. The foreigner in the U.S.S.R. who has soaked himself in nineteenth-century Russian fiction and poetry finds himself among familiar people: for despite the prodigious upheaval of the revolution, the personality of the Russian people has not changed much. Their fortitude, their naïve absence of hypocrisy, the extraordinary blend in their character of hardness and kindness and of cunning and frankness, their acceptance of obstacles caused by human interference as though the obstacles were 'acts of God': all this appears in the stories of the nineteenth-century novelists. And all this appears in the twentieth-century Soviet citizen. The Russian personality colours science in the Soviet Union as surely as it colours Soviet poetry or politics. It explains some of the strength and weakness of Soviet science: the strength, for instance, of Soviet exploration, and the weakness of Soviet statistical work.

It is, therefore, not out of place to brighten these essays on Soviet science and education with some picture of the social context in which the people work.

Many a Russian story is set on a railway journey. The unhurried pace of the train, the leisurely talk, the cups of tea, the dim light; these are just the medium for the Russian personality to be revealed. Accordingly I include here, just as I wrote it at the time, a diary of a journey from Moscow

to Murmansk and back. This journey had two objects: to see what lay behind the Soviet claims to have introduced intensive agriculture into the Arctic; and to see something of Arctic and sub-Arctic vegetation. Both these objects were fulfilled; but the most valuable result of the journey was a better understanding of and sympathy with the Russian character, the result of living for six days and nights in the intimate company of Soviet citizens.

I have picked from my diary two other illustrations of the Russian atmosphere. The first is a formal occasion: the funeral of my acquaintance Boris Keller. The second is an informal occasion: the amusing experiences (of a kind not uncommon in Russia) incidental to a visit to a collective farm. These, too, are printed very much as they were originally written.

MURMANSK TRAIN JOURNEY

22 August

Arrived at Severni station, Moscow, about 11 a.m., in pouring rain. There are three ways of travelling on the train: cattle trucks, which were filled with labour-corps men and some private soldiers; 'hard' carriages with closely fitting wooden bunks—about three feet of head-room between each; and misnamed 'soft' carriages, where the traveller is not required to provide his own bedding for the wooden bunks, and is issued with a palliasse. Already there was a fight going on at the door of one of the cattle trucks—the men already inside were preventing any more from entering. The 'hard' carriages were full, with people standing at the entrances and even on the steps, and there was a fierce woman attendant outside the 'soft' carriage barring the way against all but authorised travellers.

The compartment in which I spent the next three days and nights with three Russians was smaller than a sleeper compartment on a British train. It had four horizontal

wooden bunks; no springing, no mattress, no cupboards, and only one hook—three inches above one of the bunks, and therefore useless. There was a small table by the window with a very dirty cloth on it. After the train had started we were each issued with a greasy palliasse, two dirty sheets, and a blanket. The issue included some bed bugs. My companions for the journey were a young lady from the information bureau of the Intourist Hotel at Murmansk, an N.K.V.D.[1] colonel, a Soviet merchant seaman (chief engineer on a coastal vessel). The girl came in first after me and wiped the rain off her hair (she had no hat); then the N.K.V.D. colonel, who took off his great-coat and went out into the corridor (where he spent a great part of the journey); then the merchant seaman. The merchant seaman immediately broke the ice. Were we all going to Murmansk? He had just had a holiday, given to him by the Government after four years in Murmansk. He had been to Sochi and the Crimea. Oh, the grapes and apples there! Tied to the top of his luggage was a full-size tommy gun, made out of wood, with a loud rattle, when you turned a handle. He got it in Moscow yesterday for his son. 'See how it goes—hands up!' Then he pointed it to the N.K.V.D. colonel, who smiled faintly and turned his back. The sailor winked at us and grinned, showing a row of enormous stainless steel teeth.

The sailor knew the ropes. He unpacked a towel, soap, half-a-dozen parcels of food, an onion, half an apple, a knife, and an aluminium water bottle (a trophy from a dead German, he told us). He went along to the attendant's compartment and returned with the flask full of hot water. He dropped in a little tea, had a drink, got his issue of bedding, climbed up to his bunk, and went to sleep.

The Intourist girl knew some English and wanted to practise it. She told me she had been in Murmansk through one year, and had just had a month's holiday with her parents in Belorussia. Their home in Minsk had been

[1] N.K.V.D. is the modern successor to the O.G.P.U.

destroyed, and they were living in a room while another home was being built. The girl was 23, and a year ago she had married a lieutenant-colonel in the tank corps, who is at present in Berlin.

We passed through birch and fir forests, and wheatland, mostly harvested and in stook. What harvesting was still going on was being done by women with sickles. There was no sign of any mechanical harvesting anywhere. On one farm the wheat had been brought in from the fields and was being threshed. A band of about ten women was carrying the stooks to the thresher from a pile in the courtyard of the collective farm.

1 *p.m.*, *Zagorsk*. A persistent crowd tried to board the train. Our tough woman attendant stood at the door and barred all comers; only a dog got past, and was promptly thrown out again. The N.K.V.D. colonel complained that there were no electric-light bulbs in the compartment. 'There aren't any', she said. 'After dark you go to bed.'

2.15 *p.m.*, *Alexandrov*. The station was packed with people. The same tussle took place at the door of every coach, when people tried to get in and were only prevented by physical force from the attendant (usually a woman). A young couple, with two suitcases, slipped on to the buffers at the end of our coach, and climbed up a ladder to the roof. They settled down there, having lashed their suitcases to one of the ventilation chimneys. A young girl (16 years old, perhaps) ran along from coach to coach weeping, as she was turned away from one coach after another. Just as the train was going she got a foothold on the steps of one carriage, and her cases were pulled in by a soldier. Dozens of other people, after trying to get on to the train, retired to the platform and sat down again on the ground to wait. The attendant told me that they sometimes waited a week before they got a train.

Throughout the afternoon we ran through heavily timbered country. About 80 per cent. of the land near

the railway seemed to be timbered, and there were huge piles of timber lying alongside the line in many places. After Alexandrov we stopped at every station, and at each stop there were crowds of people, many of them would-be passengers; and at each stop there was some incident.

In these villages, most of them built of wood and with ample gardens around each house, the arrival of the train was the event of the day. And it was one of the main opportunities for independent trading, too. The whole village seemed to be down to see the train. Even a village with a handful of houses could produce a hundred or more people on the platform. There were women, with white and coloured shawls; children, some of them very small; beggars, crossing themselves and asking for bread; soldiers. The women and children were selling milk, cucumbers (pickled or fresh), potatoes (even by the sackful), eggs, and raspberries. In Petrovskoe milk was sixteen roubles a litre; cucumbers, one rouble each; potatoes, eight roubles a kilo; eggs, five roubles each; and there were carrots and onions. Quite a hundred people waited on the platform. To add to the confusion at each station, most of the passengers get out and mingle with the crowd; and the illegal passengers (on the roof, buffers, and in the spaces between the coaches, and on the steps of each coach) drop off until the whistle blows. The train starts slowly, and there is time for most (sometimes not all) the passengers to jump on again as it steams out. The attendant has to prevent new passengers getting in, to allow legitimate passengers to get off and on again, and to intervene in the squabbles which invariably arise out of the trading at each station. At Petrovskoe a furious cucumber-seller tried to follow a passenger into the coach next to ours—the passenger had not paid the right amount for his cucumbers. The attendant let the passenger through and barred the way to the saleswoman. Whereupon the saleswoman picked up her cucumbers one by one out of her basket and bombarded the attendant with them. Her

fury died down as suddenly as it arose, and as the train moved out of Petrovskoe, the woman set to to collect her cucumbers again and put them back in the basket.

At 4.30 p.m. we stopped at a peat village. It was in marshy land, almost all uncultivated. There was not much for sale here, and there were many beggars. As I walked on the station a small child with flaxen hair and the strange hostile, blue eyes which some Russians have, asked me for bread. I asked him how old he was—he said he was eight. 'Is your mother on the station selling things?' 'No, she is dead', he answered with the same cold look. I got a chunk of bread from my food box for him, and asked him how much the mushrooms were he held in his hat. 'They are not for sale. I have not eaten yet today and I want them myself', he said solemnly. He thanked me, without any expression of pleasure in his face, and walked away. I watched to see whether he would beg from anyone else; but he did not. He walked off the station into the fields. I told the Intourist girl about it when I got back. She said nothing at the time, but when the N.K.V.D. colonel had gone out of the compartment, she said 'You know, there are many children without parents, who will not go into the homes we have for them, but live alone in the summer-time.'

While the colonel was in the compartment, there seemed to be a chilly atmosphere about it. But he spent a great part of this afternoon in the corridor, reading Tolstoy's *War and Peace*. The girl read *Charlie Chan Carries On* and the sailor read Gogol. But the sailor spent most of his time talking. He bubbled over with an account of his trip. 'Why, in the Ukraine, milk is only eight roubles a litre, and you get three cucumbers for one rouble.' Then he began to sing folk songs. After the first couple of them, I asked him to go on. He was delighted. 'Listen, I will teach you a folk song.' And he dictated to me the six verses of 'Step da Step Krugom'—one of the famous Russian songs. We all sang it together—all except the

N.K.V.D. colonel; but he did come in and sit down. (We had him singing too before we got to Murmansk.)

This encouraged the sailor to sing more songs. Then he said to me, 'Please write down your name.' I did so. 'I will call you Mister Eric, and my name is Sasha.' And for the rest of the journey we were Bella (the Intourist girl), and Sasha and Eric to one another—except for the N.K.V.D. colonel. I didn't know his name till after I got to Murmansk.

6 *p.m.* A flat, open country, with lakes and many villages with tall churches. Soon after 6 we came to Rostov, which stands at the side of a lake and has a dozen churches and a monastery like a small Kremlin—white walls, a green dome, and gold pinnacles; a beautiful sight in the evening light, over flat fields with the corn standing.

Rostov has a big station, and there was a great crowd to meet the train. It is the last town north at which any variety of vegetables can be bought. There is a row of countrywomen at stalls on the station, selling carrots, onions, potatoes, apples, raspberries, milk, eggs, tarts, and hot tea. There was a queue at the booth which supplies hot water. Small children were begging bread from the passengers. Some children off the train from Moscow were trying to sell ladies' hair combs in the crowd. I saw one child receive half a loaf of bread from a passenger. He grinned broadly and ran over to a peasant woman nearby who was selling cucumbers. 'Look, mama, look: bread.' The woman smiled and looked up and caught me looking at her. 'He is a good boy', she said.

On Rostov station there were many soldiers embarking from leave. Their wives and mothers had come to see them off, and there was an exhibition of that dignity and restraint which is so characteristic of some aspects of Russian life. They kissed goodbye, and then shook hands and bowed formally to one another. Some of the women walked off the platform before the train left, without once looking back.

After Rostov the sailor sat up at the table and ate a meal. He had made tea some hours earlier, and though it was quite cold, he drank it. He had a packet of sticky red caviare which he spread over black bread with a sheath knife. Then he put slices of onion on top. His technique was not very efficient, and he spilt a good deal of caviare on the floor and on the cloth. This was afterwards rubbed into the floor by his foot, and into the cloth by his knife, and it smelt for the rest of the journey. While the sailor was in the middle of his meal the N.K.V.D. colonel had his. He produced black bread, a jar of butter, and a tin of German sardines. I saw the label and said to him jokingly 'War trophy, too?' And he said 'Maybe'. That was almost the most decisive remark he made to me during the three days of our journey. His technique was not very good, either. He spilt a lot of the oil in trying to open the tin: some on the cloth, and some on Bella's blanket. Then he went out into the corridor and threw the rest of the oil out of the window. Some of it remained on the window through the trip. Meanwhile Bella produced cheese and bread, and I opened a tin of corned beef, some orange-juice, and produced some black bread. I had waited till the others ate in order to 'get a line' on their technique. But I made one mistake. I put the meat on a plate, instead of straight on the bread (and the cloth). The sailor pointed to the plate and said 'Ne nada' (not necessary).

Throughout the journey everyone ate for himself, at different times usually, and never exchanging food. Nearly all my efforts to share even tea or orange-juice failed. Only on the third day did I have some success: I persuaded them all to accept chocolate. Even the N.K.V.D. colonel.

During the evening we passed through wheatlands and forest. Here and there were women gathering in the sheaves, by hand into carts. We sang more folk songs, and Sasha and the colonel began to talk about opera in Moscow. Immediately the colonel became eloquent: No—Mihailov didn't sing well in *Ivan Susanin*. The

range was too much for him', said the colonel. The sailor threw out his arm in disapproval. 'On the contrary, Mihailov was the best bass since Chaliapin.' The argument went on for an hour, and at 9 o'clock we came into Yaroslavl, a big manufacturing town, which in peace-time makes motor-cars. It was almost dark, and there was nothing for sale except on the booths on the platform. In the semi-darkness, little boys ran under the train, first to one side and then to the other, asking for bread. Between our coach and the next, packed on the narrow plate between the buffers, were no less than seven people: women, children, and soldiers, with their luggage (generally in sacks). The passengers on the roof had greatly increased: I counted twelve on our coach alone, with their luggage, sprawled flat, with their faces toward the tail of the train, and their arms round the ventilator chimneys.

We left Yaroslavl in the dark, and a few minutes later we crossed the Volga. It is very wide even here, and the moon was rising right over it. We stood at the window and sang the Volga song together. Then Sasha called for 'Step da step Krugom' again, and we sang that. We were joined by two officers from the next compartment, and it sounded very good. When we had finished I heard the tune still being hummed in the compartment: it was the N.K.V.D. colonel. At the end of the first day he had slightly thawed.

There was no light, and we prepared to settle down for the night. The colonel went out into the corridor and returned in a minute with about two inches of candle. We stood this on the table, in an ash tray already containing tea leaves, cucumber peelings, caviare, and a slice of onion, and lit it. This roused Sasha again, and he asked me to sing an Australian folk song before we went to sleep. So I sang 'Waltzing Matilda', and the colonel, who was in the corridor, came in to listen.

Then we settled down to sleep. Even in the darkness I could see why the sheets are hard to keep clean: Sasha

didn't even take his boots off. The window was, of course, shut. So was the door: and the colonel even locked it. Before he went to sleep, Sasha had a last drink of cold tea. There was a sprinkle of water over my face; it was Sasha throwing the dregs out, from the bunk above. He always did it that way.

23 *August*

A fine morning. We are running through spruce and fir forests; with occasional patches of oats and potatoes. The forest is thinner and more stunted than those we saw yesterday. I get up early, in order to get into the lavatory to wash and shave before it is too crowded and if possible before it is too dirty. I am before the crowd; but not before the dirt. The water closet has already reached that incredible state of filth which seems inevitable in Russia. Already the seat cannot be sat on, and in fact there are already boot marks where Russians have stood on the seat because it cannot be sat on. The emptying device, which is perfectly simple to operate, has not been operated, and hence has now clogged up. The wash basin contains the remains of a dozen meals which have been washed up there—cups of raspberries, tea-leaves, and part of a fish. The floor has a hole in the middle which serves as a drain, but clearly this has been used for urination. The smell is strong. I have to get used to this, because the only way I can take photographs (which are, of course, forbidden) is to go into the lavatory and make shots through the open window, and I run to the lavatory before every station and every interesting bit of scenery during the next two days. So I stick it out, and shave.

Breakfast of biscuits and jam. Sasha eats more caviare, and spills more, some of it on my blanket this time. The N.K.V.D. colonel opens another tin of German sardines, and spills more oil on the cloth. I spill some orange-juice. Then the flies come in. Sasha won't have the

window open. Bella doesn't mind it open: so we get a few minutes' airing while Sasha is out of the compartment. The colonel is neutral about the window. To try to minimise the stuffiness I open the door into the corridor. But it is too late: for the lavatory smell has now percolated along the corridor, and it is better to keep the door shut. Dust blows in from everywhere, and settles on the stickiness: the caviare and the sardine oil and the orange-juice.

9 *a.m.* We are at Bojega. A northern town in fir forest; timber country. There is very little for sale at the station, only cucumbers and raspberries and some milk. The colonel hasn't quite finished his second tin of sardines, so he has wrapped the tin in a handkerchief and put it on his bed. He is more communicative this morning and listens as we talk about vegetation. I have a vegetation map of this part of Russia, which he studies closely. He is a nature lover, and he tells us a little (it is always a very little, when it is from the colonel) about the forests in Siberia. He has lived in Siberia for a time. It is a beautiful country, he says.

Between Bojega and Konosha it is mostly timber country, good trees, and mostly pine-larch forest, with occasional stretches of oats and potatoes. Konosha looks to be a new timber town. It has no old buildings and it has rows of regularly spaced timber apartment houses, very attractively designed. The only other occupation seems to be haymaking for cattle. I saw no sheep all the time; only a few cows, kept by the homestead (and inside it in winter, according to Sasha) and a few goats. Even among the trees the hay is cut with sickles and made into stacks.

Sasha talks about his decorations this morning. He has a medal for the defence of the Arctic; a medal for heroic conduct in the merchant navy (on a convoy off Murmansk) and the Red Star. He has lived seventeen years in Murmansk and loves it. Bella talks about her work, which seems to have been mainly to prevent fights between British and American sailors in Murmansk in the hotel,

largely over women, and (we were led to believe by implication) largely over herself. If this is true (and it seems hard to believe from her appearance) the Americans apparently won, to judge from her accent, and her slang, and her considerable knowledge of American swing. Bella is a good example of the vulgarity of a Russian who has become partly westernised. She has lost some of the reserve and dignity of Russia, and gained none of the hygiene of Western Europe. She cannot even use lipstick properly.

At Nyandoma they were selling only eggs, whortleberries (at five roubles for a glassful), raspberries, and tarts. I found the station was all on one side of the line, and by getting out on the other side when the attendant was not looking I managed to get a photograph of some of the travellers on the roof of our coach. At Lepsha I bought some raspberries from a lovely child, who told me she was nine years old, and who looked straight through me as she spoke, with cold, uncompromising blue eyes, like the eyes of the little boy at the peat village the day before.

1 *p.m.* I make some tea (there is hot water in the attendant's compartment) in a small teapot I brought with me. Plenty of tea. But no one will have it. So I drink it by myself. Half an hour later Sasha makes tea. Then the colonel. It is a strange shyness, for Sasha is very friendly by now, and teases me about my Russian; and even the colonel begins to ask me the English for this and that.

During the afternoon we ran through country very little cultivated. About 5 per cent. of it had been cut for hay. The forests were thick and were apparently well exploited. They consisted of spruce and fir with some birch and alder.

Lunch about 2.30, off corned beef, black bread, and water. Although I have a five-pound tin of corned beef and obviously will not be able to get through it, neither the colonel nor Bella will accept any. Sasha, when I teased him about refusing to eat American food, unwillingly took

a token helping. The colonel solemnly opened a separate tin of canned pork (American), and said that my tin of beef was an issue for ten men in the Red Army.

At Plesetoskaya, which is a small timber village, there was the usual crowd trying to board the train, which by this time had scarcely any room anywhere except on the roof—and even that on some coaches, where the ventilators are easier to hold on to, was becoming filled up. The steps were full, so were the buffers, the platforms between each coach (the end doors of the coaches were kept closed) and the ladders running up to the roof at the end of each coach. I was told the train stopped here for fifteen minutes, so I went to see the 'hard' coaches at the back of the train. At the door of one of these coaches the crowd had beaten back the attendant and forced a way in, but the occupants of the coach (mostly soldiers) pushed them out again. By getting behind a tree I managed to photograph this incident. As with all Russian squabbles, there was wild shouting and pushing and threatening at the time, but the ill-temper evaporated immediately afterwards.

Suddenly the train whistled and moved out of the station. I could not possibly have reached my coach, so I ran to the nearest one and joined the crowd trying to get a foothold on the steps. The others were handicapped by having luggage and I was not, so I managed to pull myself up there. There was no room on the steps: already seven people were standing there; but a soldier on one of the buffers kindly edged along and gave me a foothold on the base of a buffer. I hung on there for about forty minutes to the next stop. For company I had three soldiers, two children and two women, with their baggage. We managed to keep our balance by pressing against one another. The weather was fine and warm and the train did not go very fast, and for a time it was a welcome change from the nauseating stuffiness of my compartment. But it becomes tiring to hold on with both hands and to balance on a buffer. The soldier who had made room for me had a

Mongolian face, and he spoke Russian very slowly. He came from the East, but I couldn't gather from where. I asked him where he had come from. 'From Moscow.' 'And do you have to stay on your place in case someone else takes it from you?' 'At the stations we keep places for each other by turns.' 'And what do you do at night?' He pointed to the roof. 'Or', he said, 'if the weather is bad we bind ourselves on here with rope.'

At the next station were half-a-dozen gypsies. They looked to be fairly pure-blooded, with dark shining hair, quite unlike Russian hair, and dark eyes; and with kerchiefs and blouses of yellow and red and brown. They stood below the officers' carriage and offered to dance and sing for us in exchange for bread (they do not want money). I threw down some bread, and one woman danced a gypsy dance while the others clapped their hands and sang. Then a big gypsy woman came below the window and offered to tell our fortunes for bread. We refused. She flauntingly opened her shawl and revealed a child at her breast. She held up her hand again and called for bread. Sasha produced some and threw it to her. With the child still at her breast she dived under the train, and a minute later she was begging on the other side.

Another flaxen-haired Russian child came up to the window for bread. I was going to give him some when Sasha quite fiercely stopped me. 'Give bread to gypsies, if you like, but not to Russian children. All Russian children are well fed. It only spoils them to give them bread. They don't need it. They all get plenty.'

The price of bread at the booths on the station was ten roubles for a piece about half a pound in weight.

At 10 o'clock we turned in under our blankets. We had left the Archangel line and turned westwards toward the southern tip of the White Sea.

24 August

7 *a.m.* Nyuja—a timber village on the shore of the White Sea on latitude 64. It is a country of pine forests and lakes. By the shore of one lake we saw a labour camp, which Sasha said was for political prisoners. It had three separate barbed wire fences around it, and watch towers with searchlights and guards. The products of the district are peat and timber.

Sasha's breakfast was black bread and onion (it was a relief to see the last of the onion: it had stood, half cut on the table for over a day). The colonel had more pork and black bread. Bella had some apples. At Sumski Posad we stopped for half an hour. They raked the boilers of the engine (it burns only wood for this part of the journey); they piled the coal wagon high with birch logs—there is a special framework on the wagon, so that timber can be put in to about double the height of the walls of the wagon. And they cleaned the lavatories. This was done by putting a hose in through a hole in the roof and flooding the lavatory, while a woman went along under the train poking a pole into the exit holes to remove any stoppages.

It had been a fine night and there were seventeen on top of our coach: soldiers, sailors, children, women, and the original young couple who got on soon after we left Moscow. They had slept there the night, and they were lying about flattened against the roof, with their luggage lashed to the ventilator chimneys. At the station the country-women were selling only bilberries and bilberry tarts and some milk. Some of the women on the roof climbed down to get something to eat. One was dressed in felt boots, and a coat made out of a blanket, with a shawl tied round her head. The passengers who had made this journey before knew that there was time here for a wash, and they ran over to a marsh by the estuary and were there in dozens, bending over the water rinsing their faces.

After we left Sumski Posad the attendant came along to clean the compartment. She had a broom of fresh birch leaves. She used this to rearrange the dust rather than to remove it; but she did wipe round the window ledge with a wet rag. The cloth with its accumulation of food remains and its parcels of half finished food, she did not touch. Later on she wiped the corridor down with the same wet rag, and there was a fierce altercation when one officer stepped over the wet floor. The lavatory was locked till the water dried off the floor.

From 10.30 till 11 a.m. we were at Belomorsk, where the Stalin canal reaches the White Sea. It was dug a few years ago by prison labour; it is about 300 feet wide at this point. The bridge, like all bridges in this part of Russia, is protected by a series of barbed-wire entanglements and by armed sentries. Formerly this was necessary because Finnish commando units used to come across the frontier regularly and attempt to blow up the bridges of the Moscow–Murmansk railway.

There is a flourishing market on Belomorsk station (the station still has painted up its old name of Sorokskaya). Milk was more expensive than it had been further south: it was forty roubles a litre. Sugar was a rouble a lump; bilberries five roubles a glassful; bread about forty roubles a pound; fish, five roubles for five small fish about the size of sardines; bilberry tarts the size of a saucer, five roubles each. There was a booth with saleswomen in a row and a great many women and children hawking food by the side of the train. One girl who looked about 15 sold a bottle of milk to a soldier. He was supposed either to drink the milk or to transfer it into a bottle of his own, for bottles are hard to come by, even in Moscow, and are very precious in the country. The soldier paid ten roubles for the milk (it was a quarter of a litre), and then drank it and pocketed the bottle. The girl dropped her basket and went for him to try to get it back. He easily threw her off, and went back to his carriage. She tried to follow, but was stopped

by the attendant. So she turned away and slowly walked off the station. I followed her to see how she had taken this serious loss. She was crying: it is the only time I have seen a Russian give way to emotion over a loss of this sort.

At this station, as at all others, it was impressive to see how healthy the peasant people looked. The women and children were brown and fat and clear-skinned, and did not seem to be suffering from any serious food shortage. It would of course be misleading to generalise from the people to be seen at the station, for the people who are short of food (and there are said to be thousands of them) would not come to the stations to sell food. A few of the children begging did seem to be underfed, but this was not true of the majority of the people.

During the morning we ran gradually into Arctic type of vegetation. There was thin forest, made up of occasional pines and birches; a great deal of ling flowering; cloudberries and bilberries and whortleberries; and swampy ground with sedges and mosses. There were many lakes and rivers, with picturesque villages of wooden houses along the river banks. There was no agriculture at all. A little haymaking; a few potato patches and oats round the houses; that is all.

At Kem we stopped an hour. There wasn't much for sale—mainly bilberries. I saw how the N.K.V.D. control the market at Kem. An officer bought bilberries from a woman, and complained of short measure. She told him he had been given full measure. Thereupon he rudely seized her glass and began to help himself to more bilberries from her basket. She tried to restrain him. A militia man came up, heard the officer's complaint, and without waiting to verify it, or to question the woman, he threw her glassful of bilberries across the railway track, took her basket of bilberries, and walked off the station, leaving her without glass or basket. She showed no sign of emotion on her face at all, and simply walked off the station, in another direction.

Late in the afternoon we stopped at Engozera, a village surrounded with moorland which came right up to the railway track. Dozens of passengers got out, while the engine was being raked out and more wood was being loaded on, to pick flowers. It was a strange sight to see Red Army soldiers bringing back great bunches of flowers to the train.

The weather is breaking, and we shall have rain. The compartment smell has grown rather worse, for there is some milk added to it now, and another onion. The lavatory has lost all sign of its morning clean-up. We are singing some folk songs, and the N.K.V.D. colonel is becoming quite communicative. More about the Siberian forests. Then he talks with me about poetry and begins to recite Pushkin. The cloudberries made him think of Pushkin; for Pushkin on his death bed asked for cloudberries from the Arctic.

Sasha and the colonel are having an argument about religion. Sasha (being a sailor) is still religious and tells the colonel so. The colonel replies with the stock arguments, the sort of arguments that were common in the religion-versus-science period of the nineteenth century. Bella does her best to interpret the conversation to me.

Toward evening the colonel becomes more willing to talk, and he asks me about the atomic bomb.

9 *p.m.* Heavy rain, just as darkness is falling. There are two leaks in our compartment, one at the door, and the other over the colonel's bunk. The colonel calls in the attendant. She suggests hanging a tin can under the lamp holder, which is the source of the leak. So the colonel gets a pork tin, not quite empty, and bores a couple of holes through the top with his knife. We put string into the holes, and together we manage to hang the pork tin under the lamp holder, to catch the drops of rain and to prevent them falling on the colonel in his bunk.

The attendant herself gets into trouble at the next village. She runs across the line to a pile of timber and brings back a large log. It is to barricade the door, for if it comes on to

rain heavily in the night, the passengers on the steps, buffers, roof, etc., will try to get into our coach. A second or two later, and there is a string of abuse from a large and healthy young woman who is the guardian of the wood pile. But when our attendant explained what the wood was for, the argument suddenly collapsed and there were broad grins on both sides; and they parted friends.

Along this part of the line there was evidence of bombing at almost every bridge and station. The guardian of the wood pile told me that there was bombing almost every night in her village, where there is a bridge across the river.

25 August

We crossed the Arctic Circle about midnight. At Kandalaksha, which we reached at 3 a.m., the steam engine was taken off and an electric engine put on. The line is electrified all the way to Murmansk. The Russians are justly proud of this achievement, and it is part of their plan to electrify this line from Murmansk to Leningrad. The electric train was much quicker than the steam train. Stops at stations were never more than a few minutes. In the morning we ran round lake Imandra for an hour or more. It is a very beautiful lake, surrounded by Arctic pine and birch forest, made up of dwarf trees some ten to twelve feet high, and with an undergrowth of moorland plants. For the rest of the journey we went through electric power stations, with neat groups of workers' apartments built around them, or through old fishing villages on the Kola River. The Kola River itself runs first one side, then the other side of the railway for fifty miles or more. There was no agriculture at all, except a few patches of potatoes and oats. The potatoes looked healthy; the varieties grown are Vermont, Snowflake, and Imandra. Only the last of these is a Russian variety. The commonest variety is Vermont. Crops are poor but adequate. The oats do not always ripen, and it did not,

look as though they would this year. They were not nearly ripe, and there was scarcely a month to go to the snows. I asked the colonel whether there was more agriculture in the Siberian arctic. 'No', he said; 'the same as here; no different.'

We arrived at Murmansk precisely on time, seventy-one hours fifty minutes after leaving Moscow. Murmansk is large, ugly, sprawling with docks, warehouses, workers' apartments, and half-built factories. Almost every brick building in the town has been bombed. There is scarcely an unbroken window left in the town. It is surrounded by hills of granite, with dwarf pine-birch forests, lakes, and swamps.

Bella went to the Intourist Hotel. Sasha was met by his wife and ten-year-old boy, who solemnly clutched the toy tommy gun, and refused to turn the handle. I was met by representatives of the British Naval Mission. I asked the Naval men who the N.K.V.D. colonel was.

'Oh, he's back, the bastard. He is the boss of the N.K.V.D. for the whole Kola peninsula.'

RETURN JOURNEY

30 *August*

Was taken down to the station by the Naval Mission. Large crowd to see the train off. My only companions at the beginning were the producer and manager of the Murmansk theatre (there is a government theatre even in Murmansk, with many imported actors who are attached to it), and Bella major. Bella minor was the Intourist official who travelled up with me from Moscow. It is hard to imagine anyone of the same height being even fatter, and when the Mission told me that there were two Bellas in the Intourist Hotel, and that I had only seen B. minor, not B. major, I did not believe their description of B. major. But they were right. She is perfectly spherical;

very Jewish; would look at home outside a fur shop in Wardour Street.

Soon the producer went off to another compartment, having found a friend. Bella major and I were left alone. She looked older and less silly than B. minor. And I knew something about her from the Mission. The senior lieutenant described her as 'clean and willing'—which you can guess the meaning of. She has been living with the master off a torpedoed Swedish steamer while it is being repaired: so she is well-dressed and shod. She turned out to be pretty rugged (as they say up here), but intelligent and with a heart of gold. The important thing was not to look at her. She discovered, a few stations down the line, a young couple with two children (youngest nineteen months) with no seat and the prospect of living in the corridor all the way to Moscow; so she asked whether I would mind if they occupied my empty bunk (the navy had taken two for me) and the other spare bunk (which they bribed their way into getting). She asked in such a way that she would have been disgusted if I refused—which of course I didn't, anyway. It was good to have Russians really concentrated when you went to study them. So we slept six in four bunks that night: I went up above because the poor mother with the baby shouldn't have to climb up there; opposite me was the father with the small daughter; down below Bella major (occupying the whole bunk and lapping over the edge); and the mother with the baby. Before they slept they all fed in their various ways. But B. major, having enjoyed the flowers of sin with a European—and a Swede at that—had picked up some of the better fruits, too. She was almost hygienic about food, and the cloth, and washing cups, and she hasn't once yet combed her hair into the fish: one of B. minor's common failings.

Towards evening we came to a village just above the Arctic Circle where an old man was selling little bunches of flowers. They must have come up by rail, or possibly been

grown in a glasshouse. The bunches were very small—they had a couple of snapdragons, two or three pentstemons and pansies, and they were fresh. There was a great rush for them at seven roubles each. I saw women climb down from the buffers (they were already there) to buy a bunch; and the strangest sight of all: a tough young woman, not more than 19, with flaxen hair, and a shiny greasy boiler suit, climbs down from the engine and buys a bunch. She is the engine-driver. In fact I don't remember seeing an engine-driver on this trip who was not a girl.

For hours we ran round Lake Imandra, which we had missed through darkness on the way up. The forests are thin—mostly birch and pine—but are being cut for firewood. I counted three prison camps, with the usual barbed wire, wooden fence, and four look-out towers, in clearings in these forests. These I was told were for N.K.V.D. prisoners, not for Germans.

The train ran out of water—as far as the passengers are concerned—at Kandalashka. So they have locked the lavatory again; much to our discomfort. Our views have been forcibly expressed to the little conductress (a much milder one this time, who doesn't succeed in keeping people out) by a full general, who is in the next carriage to me, and who is very swashbuckling and noisy.

31 *August*

We are below the Arctic again, in better timbered country. All the landscape is forested, and there are broad fine rivers every few miles, crossing the line and running into the White Sea; and rafts of logs are everywhere floating on the rivers. Among the trees some poor cattle are grazed, and there has been a little haymaking. I saw at Sumpski Posad a team of five women going off with sickles to cut hay. Apart from this hay and a few plots of potatoes (never as much as half an acre at a time) there is no agriculture. The forests have been heavily cut and are regenerating well.

I counted in one place, where the train stopped, five times as many young trees as there were stumps of old trees in a patch of about a quarter of an acre.

At the first big stop in the morning (Belomorsk) they put water on, and the little conductress cleaned the lavatory and put some flowers in there! After I had washed and shaved she told me to come and fetch some tea. In a recess at the end of the corridor there was a samovar, smoking and bubbling. So we all assembled in various stages of half dress in the corridor (the general in a striped blue sweater like a footballer) and had tea in teapots, glasses, mugs, cups, tin canisters—all sorts of vessels. There was great confusion, for the soft-hearted conductress had let in half-a-dozen gate-crashers. Four sailors and some nondescript men with lots of baggage now almost fill the corridor; so it is even harder than usual to get along there.

An hour later. Bella is sitting like a very fat frog opposite, reading Elinor Glyn, with her folds of flesh rolled over one another. The elder of the two small children is drawing with a pencil I have given her. The mother (who is very considerate—fat and efficient) is feeding the child with bread and milk in the corridor, to avoid mess. It is nearly 1 o'clock and soon we shall get out our bread, and water, and tongues, and jam, and have a meal. B. major sensibly shares tins with me, so that we don't have two lots open at a time. She is turning out to be a satisfactory travelling companion—doesn't talk much, reads, doesn't interfere, and isn't too dirty. The smell is many points below the smell we had on the way up; but perhaps that is due to the weather, which is quite cold now.

Evening. We have had various excitements in the last two hours. Water has run out again in the lavatory. At one station there was a great altercation from the buffet car (almost exclusively for generals, for its prices are prohibitive for everyone else) and some drunks were thrown out. Apparently there had been trouble with drunks all the way from Murmansk, so at this station the director of the train

had the buffet car taken off. It was in the middle, so they had to run half the train a way up the line to some sidings to get rid of the offending coach. That kept us at the station (in pouring rain—it has rained all the way down from Murmansk) for over an hour.

Just as we were getting in to start again, a lady was hustled into the admiral's compartment. No one had seen her before and our attendant tried to keep her out and shouted that she hadn't a ticket in our coach. But no one took any notice and she disappeared into the compartment where there was already the admiral and three other Russian naval officers. So one bunk will have to accommodate two people.

1 *September*

The lady is still in the admiral's compartment: I caught sight of her having breakfast there this morning, with all four of them. Our attendant makes up in cleanliness what she lacks in toughness, for although she fails to keep out unauthorised passengers, she does come in every day with a bunch of birch twigs, which she dips in water and then uses to sweep the floor. Even the lavatory hasn't reached the customary state of dirt. Bella major is still sleeping and she forms a huge mound in the opposite bunk. The mother and child are outside; so is father; and the eldest of the two children is drawing in the top bunk, having just had a game with my typewriter. She has typed the numbers 1 to 10 and learnt the English for them.

At the peat village a strange thing happened. The little boy whom I gave some bread to, on the way to Murmansk, was there again, selling cucumbers. He came up with a broad smile and gave me one. He didn't seem to want money; but he accepted some cigarettes.

Bread was still short there. A sailor from the train auctioned one loaf of black bread. He held it up and it was watched in silence by a crowd of women and children. It

fetched 120 roubles. An old woman with two children paid him the money and took it away. The sailor went back to the train with the crowd still looking at him.

It is flat swampy country, and for miles the road joining the villages together is made of wooden planks, floating on the marsh, and apparently not the width of two cars.

At Fominskaya it was raining, and the rain damped the market considerably. Fortified by my success in riding on the buffers on the way up, I tried a small experiment. Fominskaya is one of a number of villages close together, and I knew if I got into the wrong compartment I wouldn't have to stay there long. So I waited at the back of the train, and when the whistle blew I climbed into one of the three cattle trucks, at the open door.

There were some disapproving shouts as I got in, but when I said my place was further up the train, and when it was clear that I was a foreigner, they said no more (except one sailor, who kept on saying 'good morning' with a friendly grin). There must have been between forty and fifty people in the cattle truck. Too many to count, for they were packed very tight on the floor and two shelves, on either side of the door, and in the space opposite the door. I would guess the shelves (of rough unplaned wood) to be eight feet deep from the front to the back, and about seven feet wide across the truck. On these were piled what seemed almost a mush of humanity; you could hardly tell which clothes belonged to which people. I think most of the passengers were women and children: there were a lot of children under ten. There was a soldier with medals, some pioneer-corps men, and some sailors. There was every form of luggage, sacks, suitcases, bundles in blankets, parcels of food (mostly chunks of black bread and some bottles of milk), and cans. One woman was still washing her child's face from the half-pint mug of water picked up at the station we had just left. The only bearable place in the truck was near the open door, and this had apparently been given to the women with young children—for obvious

reasons—so I found myself sitting, with my legs dangling over the edge, among three or four babies, and some solemn-faced pleasant-looking women. Some of them were very dirty; some of them were clean and had white kerchiefs round their hair. They all looked tired and there was little movement except an occasional scuffle; and there was scarcely any talking. At the back of the truck it was possible to distinguish men asleep. The women with children near the door couldn't very well sleep, for there was very much pressure from behind so that you needed to be alert to hold on. Although the sides of the truck were open for about six feet, it was very sticky and stuffy from all the tightly packed people inside.

It is difficult to know what sort of people travel in these trucks, under such miserable conditions. They were not labour on draft. (At Vologda I saw a whole train 'on draft' bound for the Urals, composed of the same kinds of trucks only, with women and children predominating.) They were travelling back to Moscow. Possibly they were families joining their husbands who had been drafted there; or people without tickets, whose travelling is winked at; or refugees returning from evacuation.

At the next station I was glad to get out. There was a surge towards the entrance on the part of mothers with babies. I dropped off and returned to the 'soft' compartment, feeling that I was not really travelling 'Russian' at all in my compartment, with only six for four berths.

At Vologda the country opens up. About 75 per cent. of it is wheatland, now mostly in stook. I saw harvesting only in two fields (probably because of the recent rain); in each case the harvesting was being done by a primitive reaper, pulled by a horse. There is a lovely monastery, and wide cornfields running down to the Vologda River, wide and slow-flowing and full of water.

We stayed an hour at Vologda—at least we should have done. In fact we stayed an hour and a half, while a violent argument was settled with the militia, about roof travellers

on our train. It is a big station, plastered with statues of Lenin and Stalin, and with an immense picture of Stalin with his arm around a little child who has given him a bunch of flowers.

This picture of Stalin was right opposite the draft train I told you of; packed, forty or so to the truck, with families, mostly very young. I asked at one truck where they were going. They said to the Urals. The women were perspiring, they were packed far too tightly to attend to the children properly. It was evening, and the train drew in as I watched, and the children were tired and restless. There was crying and scolding in many of the trucks. When the train stopped, most of the people were unwilling to get out—in that crush they might not get in again. One oldish woman got out with a very young child, too young to be her own. She went across to the little overgrown garden in the middle of the platform, under the board of pictures of the patriotic war (including a picture of Stalin). There she pulled the pants off the child and squatted him on the grass; and then proceeded to do the same next to him. I shall always regret I didn't get a photo of that group, with the background.

Meanwhile there was trouble on our train. The roof was pretty heavily populated by this time, and a militia man walked up and down shouting them off. It had very little effect. Then he got on the roof himself, and walked along threatening them. They dropped off, coach after coach, as he went along. At the end of our coach a very tough-looking man, with a bundle, slid down and edged a girl in a print dress (red with white spots, new-looking) off her place on the buffer. She accepted defeat, and stood by, hoping for another place to appear. Bella major with an earthquake of a sigh, said, 'No—she did not get on. There will be more trains.'

At Vologda we changed from a 2–10–0 engine to a 2–6–2. The next morning, at Alexandrov, we had an electric engine to draw us into Moscow, and we arrived on

time, seventy-one hours fifty minutes from Murmansk. I took leave of Bella major, and the family with the two children (the father was an engineer in a nickel mine up north). Soviet trains always arrive on time: that is one of their great virtues. It is impressive to enter the Severni station at Moscow exactly seventy-one hours fifty minutes after leaving Murmansk, when that is the advertised time. What is the secret of this efficiency? It is (as always in Russia) Fulfilment of the Plan. The plan is to cover 2,030 kilometres in just under seventy-two hours, with long waits at many stations. To fulfil the plan it is necessary to run the train at an average speed (including stops) of 17·7 miles an hour. The train is capable of three times that speed, at a pinch; so anything short of disintegration of the rolling stock does not seriously affect the programme.

A FORMAL OCCASION—A SCIENTIST'S FUNERAL

On 29 October 1945, the distinguished Russian botanist B. A. Keller died. He was in his seventy-second year. He spent his life in teaching and in research on vegetation, and he had a world-wide reputation. He was an Academician and he had been President of the Turkmenistan Filial of the Academy. He had held chairs in two universities. He was a Deputy of the Moscow Oblast Soviet of Worker's Deputies and a member of the Executive Committee of the Moscow Oblast Soviet. He was for a time Director of the Moscow Botanic Garden. In his old age he became celebrated in the Soviet Union as a populariser of science. He was a gentle, humorous, sparkling little man who lived in one of the Academy flats, surrounded by books, manuscripts, and dried-plant specimens. His only companions were dozens of potted aspidistras and ferns and crassulas, which languished precariously against the curtained double window in his sitting-room, and a devoted manservant. There, up to

the time of his last illness, he was writing a book on the control of evolution by the environment.

Two days after Keller's death, he was given a 'red funeral' in the lecture theatre attached to the biology block of the Academy of Sciences. All the morning masses of flowers and wreaths were carried into the lecture theatre, and arranged behind closed doors. In the afternoon people began to arrive. The doors were opened and at 3 o'clock the ceremony began.

The lecture theatre was bright with flowers. Standing up against the wall were giant wreaths, some of them four or five feet high. On the small platform, behind a bank of chrysanthemums and almost hidden by palms, a string trio was playing softly. In the middle of the hall, lying on a bank of moss and flowers, was the body of Keller, dressed in a black suit, collar and tie, with his little white beard powdered and combed neatly, and his hands folded. At his feet on a red velvet cushion lay his decorations, and at his head was an immense photograph of himself, draped in black and red cloth. At the four corners of the bank of flowers on which he lay there were four colleagues, with black bands on their arms, who stood at attention and gazed at the corpse. Every five minutes this guard of honour was changed: another four colleagues or students filed in and took up their positions. The hall was filled with eminent biologists, party members, students, and workers from the Botanic Garden.

The music stopped. Academician Orbeli, Biological Secretary of the Academy, stepped forward to where the body lay, and delivered a brief talk about Keller's scientific research, his explorations and journeys, his work as propagandist for Soviet science, and his loyalty to the Party. He stepped back and the soft music started again. Then Lysenko stepped forward, and spoke rapidly and nervously about Keller's value as a populariser of science and as a good communist. After Lysenko, some of Keller's colleagues spoke: Maximov, Sukachev, and the

director of the Botanic Garden. They emphasised his contributions to science and ended by addressing Keller (in the familiar second person singular) ' Sleep quietly, Boris Alexandrovich; sleep quietly. Your work will go on.'

The trio played again, and the four colleagues around the bier were relieved by another four. Then came speeches from the secretary of the Moscow Soviet, an agitator of the Scientists' trade union, the Secretary of the Communist Party branch of the Academy, and representatives of other political organisations. All these speeches bore the same theme: Keller was famous ' not only as a scientist, but . . .', and then followed praise for his work as a propagandist, as a spreader of the glorious Soviet science abroad, and for the masterly way in which he used dialectical materialism as the basis for all his thought. And the speeches ended with ' Sleep quietly, Boris Alexandrovich ', and the speakers' arms outstretched over the body.

More music, followed by a third set of speeches. There was a speech from one of Keller's students, a young woman of twenty-five or so, who could scarcely talk for tears. She spoke of his enthusiasm as a teacher, his patience, his good nature, and his affection for his students. And last of all came one of the gardeners from the Botanic Gardens, in his labourer's coat. He spoke brokenly of Keller's unfailing kindness as a man to work under, and he, too, ended his speech shyly with ' Sleep quietly, Boris Alexandrovich '. While he spoke I watched one of the women labourers in a corner of the hall. She was wearing her rough kapok coat and she had a white shawl over her head. She turned round quickly, weeping, and inconspicuously she crossed herself.

After the speeches the trio played again. The ' red funeral ' was over. The people emptied out of the hall. The body was covered up and taken away to be cremated.

AN INFORMAL OCCASION—CAR RIDE TO A COLLECTIVE FARM

After weeks of requests, telephonings, and complaints, it was arranged that I should visit a collective farm. The trip was organised by the Society for Cultural Relations with Foreign Countries, the notorious VOKS. I took with me a member of the British Embassy, and VOKS brought along a Hungarian film star who had been invited to Moscow by the Russians on a goodwill visit. There were two VOKS representatives to look after us: a vacuous young man who because of his bland and childlike appearance was known as 'Cupidon', and an intelligent young woman who for the purpose of this story may be called Natasha. For my benefit the Chief Agronomist of the Moscow District was added to our party. We had two cars: mine, a new Buick, driven by Nikolai who was the all-time low in chauffeurs; and a VOKS car, a small Opal, recently liberated from Germany.

From the beginning everything went wrong. I picked up my British companion at the Metropol Hotel, and when we came out the car wouldn't start. Battery flat. I asked Nikolai why he hadn't told me before we set out. He only grinned, and we pushed the car round the Revolution Square with the help of three volunteers, until we got it going. Then we drove to the National Hotel where we were to meet the VOKS representatives and the film star. I told Nikolai to keep the engine running. He obeyed with a vengeance: he backed the car against the hotel entrance, and raced his engine, thus driving a jet of exhaust across the busy pavement and into the door. He kept this up for about ten minutes. After the delay which one expects when waiting for film stars she came out, attended by the two VOKS representatives. We were introduced. Cupidon tried to guide her into the little Opal, but she spread out her arms, cried 'Ah! Looveley Buick. I weel

com weeth you ', and dived into my car. This was not according to the plan, but Cupidon took it in good part, and we set off. Just outside the National Hotel there are the traffic lights at the end of Gorki Street. The lights were against us. Nikolai stalled his engine and gazed at me with a faint smile. ' We need a new battery ', he said.

The British Embassy is accustomed to the habits of Russian chauffeurs, who run their batteries down every two or three weeks, mainly by blowing the horn. So we left Nikolai to start his car and to pick up a new battery from the Embassy, and we waited for three-quarters of an hour, during which time the Chief Agronomist gave us a lecture on how to increase the yield of potatoes by digging them up, removing the tubers and replanting the vines, twice during the season. He quoted some staggering figures. We were over an hour behind schedule by the time Nikolai returned. We set off for the farm, fifty miles out of Moscow. The film star stuck to the Buick.

The Opal drove on ahead of us. Once outside Moscow there are good open roads, but Nikolai continued to drive at about twenty miles per hour. I asked him to hurry, and his only reply was to quote the Russian proverb ' *tische yedesh, dalshe budesh* ' (he who goes slower fares further). I explained that we were late, and he replied, ' We cannot go faster. The oil isn't working. There isn't any.' It wasn't true, or the car would have seized up; but the dashboard indicator was not recording any pressure. At last we turned off on to the farm road. Like all farm roads it had an awful surface. Instead of driving steadily through the mud, Nikolai would wait till he reached a particularly sticky patch, and then stop his engine, get out, take off his cap, scratch his head, and exclaim ' *Borje moi*! ' (my God!). Then he would race the wheels and we would slide about helplessly in the mud till we were off again. The last mile of this trying experience was along the edge of the Moscow river, which lay some eighty feet below the track. We slithered along this part, tense and silent, not daring to

look at each other. Only the film star spoke. 'Kill him before he kills all of us', she cried. At midday we arrived at the farm.

We were heartily welcomed by the farm Chairman, Nikolai Ivanovich. He told us he had been a peasant under the Tsarist regime. He was born in the village. Now he is its benevolent dictator. He is a man of about sixty with the heavy walk and rough red complexion of a farmer, and the shrewd eyes of a peasant. He has a great sense of humour and a booming voice. He was wearing three decorations: the Order of Lenin, the ubiquitous medal for the Defence of Moscow, and a gold medal for agriculture; but he had none of the pomposity so common among the little bureaucrats of Russia. He had the confidence of a man who knew he was 'the boss'.

Nikolai Ivanovich took us to the office of the collective farm. It was spotlessly clean and had, I suspect, been painted for the occasion, for the blue paint on the floor was not quite dry. The office was gay with flowers and potted plants. Immediately behind the Chairman's seat was a life-size bust of Stalin, and there was a small bust of Stalin on the green baize cloth between two inkstands. On the other side of the office hung a collective picture of the Politburo.

We sat down and lit cigarettes. Nikolai Ivanovich told us the familiar story. In Tsarist days the harvests were always poor. The peasants who could not get work with the local landowner drifted away from the village and the Kulaks took their land. The village was not even self-supporting in food: it had to buy from outside. But in 1931 the village was organised into a collective farm, with eighteen families in the collective. A year later the collective contained 200 families. Their yields increased from ten to fifteen centners per hectare. Then the war came, and the men all enlisted. Nikolai Ivanovich organised the farm to be run by women. 'I call all my women *krasavitsi* (beauties),' he said, 'and then they work even better than

the men.' Under the *krasavitsi*, despite the shortage of machines, yields have been higher than ever before.

For two hours we questioned him and he took great trouble to answer our questions. He produced for us the farm records and the work-books of the members of a brigade. He told us how the wages were paid, and how the children were looked after while their mothers worked. He boasted that the farm of 2,700 acres supports 1,000 people, in 218 families; and that it has no less than 119 full time workers and 241 part time workers. And at 2 o'clock, before we had seen anything of the farm outside his office, we were invited to sit down to a prodigious meal: salads, meat pies, cucumbers, onions, cabbage soup, wine, brandy, and vodka. For an hour we ate and offered toasts to one another. Then we made a tour of the farm. It is well kept and efficiently run, as one might expect with such a cohort of workers. In one barn we came across some girls sitting in a circle, cutting the tops off onions. One of their number had a balalaika, with coloured ribbons hanging from the neck. She had been playing to them, but she was too shy to perform for visitors.

At 5.30 we were brought back to the office, to find another meal, larger than the first. We settled down to enjoy ourselves, Russian fashion. You stand up and with your fork you spear a piece of bread from this plate, a hunk of pork from that, and some cucumber from another. If your companion isn't eating enough, or fast enough, you encourage him by spearing some more food and pushing it on his plate. It was all in good part and very cheerful. We got up in turn and offered toasts: to Stalin, Truman, and Attlee; to the women of the farm; to a good harvest; to the chairman's health. The film star, who had listened to the talk of manuring rates, milk yields, and breeds of pigs, with admirable patience, now warmed up and asked the Chairman to sing folk songs to us. He stood up, solemn-faced, and waving his arms imperiously he conducted the whole party (about ten Russian officials

from the farm) in the singing. They sang half-a-dozen songs, all out of tune, all *fortissimo*, but it was done so naturally that it was very impressive.

The Chairman was obviously good for the whole night. In fact he asked us to stay the night, but the proposal was crushed by the anxious intervention of Cupidon, the VOKS representative. It began to get dark, and I felt apprehensive about that mile of muddy road along the river, with Nikolai the chauffeur probably a bit the worse for vodka. So I tried to make a move. The Chairman promptly put his arms on my shoulders and pushed me down. 'So you do not like our hospitality?' he said. We were all anxious to stay on, except Cupidon, who had his plan to fulfil, and the Agronomist, who by this time had reached a condition of benign torpor. So we sang some more songs and we drank some more toasts until about 8 o'clock, when the party broke up, and we left in our two cars, with many handshakes and mutual expressions of affection.

Nikolai was perfectly sober, but his eyesight was bad, he said, and he wasn't sure we would get home. One of his weaknesses was to drive me far into the country and then to find he hadn't enough petrol to drive me back. So on this occasion I had asked him to check the petrol tank and be certain we had enough; and if the petrol was short, to get some from the farm. He said we had petrol, and we set out.

We passed the dangerous stretch of road safely. Nikolai kept on saying 'I'm frightened', but nothing worse happened. We were about two miles from the farm when my car stopped. Nikolai's immediate reaction was to lift the bonnet and to unscrew something, which clattered down and was lost in the mud underneath. We tested the spark: it was all right. In despair I put a stick into the petrol tank and examined it in the headlamp. It was dry. We had run out of petrol.

It was no good cursing Nikolai. We sent Cupidon and the Agronomist in the Opal car back to the farm for petrol,

and we settled down to rest. Nikolai sat in the driver's seat and fell asleep. The film star put her head on my shoulder and went all limp. Two hours passed. It seemed ample time for the Opal to have fetched some petrol for us. I had visions of the Agronomist and Cupidon still at the dinner table, or under it. So we awoke Nikolai and sent him back on foot to find the Opal. It was about ten o'clock.

Shortly afterwards the Opal came. The delay was easily explained. The radiator had fallen off. Sure enough, the bonnet and part of the radiator were in the back and the engine was naked. They had the petrol, in an enormous glass bottle. But no Nikolai.

'Didn't you meet Nikolai?', I said. 'I sent him to find you?'

'Yes,' they answered 'we told him to stand on the back bumper bar. But he must have fallen off': and they looked behind to make sure.

Nikolai appeared a few minutes later. He had fallen off, but he was quite cheerful. With a rubber tube we proceeded to siphon the petrol into the Buick's tank. In the middle of this operation Nikolai, who was holding the tube, lit a cigarette. I rushed across to him and told him to put it out. 'Don't worry', he said quite calmly, 'this is Soviet petrol. It's so bad it doesn't burn.'

With petrol in the tank we became more cheerful, and we set off again. The driver of the Opal had a theory that he should compensate for the lack of a radiator by driving fast to make a draught. So he and Cupidon went on ahead and we saw no more of them. We ambled along at twenty-five miles an hour, because Nikolai still thought the oil wasn't working. About 10.45, on the main road but still in the remote country: bump—bump—bump, a burst tyre.

We drew into the side of the road. Nikolai got out, looked at the wheel in silence, and said: 'Unfortunately I have no spare wheel.'

'Have you a repair outfit?'

'No, sir.'

'So', said the film star, 'we must spend the night in thees car?'

'Yes.'

'Empossible. I shall die. I shall kill you and I shall die.'

Natasha simply said in English 'dear God!' over and over again. The Agronomist turned over and went to sleep.

We were twenty-five or thirty miles from Moscow. Natasha and I decided to walk to the next village, and to telephone for another car from the Legation. We walked about a kilometre and came to a village. Nearly all the houses were dark. There was a light in one house near the road. We stumbled across to it and knocked on the window. A woman answered. She wouldn't open the door at first (people never do in Russia), but when we had explained what we wanted she let us in. She was the village school-teacher and she was correcting exercise books. Yes, there was a telephone in the village. But unfortunately it didn't work. We might make sure. So she put on her coat and we went over a field to the office of the village Soviet. By tapping the window we aroused the chairman of the Soviet. No, the telephone didn't work. But two kilometres up the road there was another village. They had a telephone too. It probably worked.

So Natasha and I walked another two kilometres along the road, and we came to the next village. We saw a light in a house, and we went across and knocked on the window. The curtain was drawn back. There was a woman in bed on one side of the room and three children on the other.

'What do you want?'

Natasha explained. Yes, the office of the village Soviet was two houses up. There was a telephone there.

We went two houses up. It was in darkness. We

knocked at the door. A woman answered with a volley of abuse. No, there was no telephone here. This was not the office of the Soviet. She wouldn't open the door for us or for anyone; and the Russian equivalent of 'Get to Hell out of here'. We thought we had made a mistake and we went back to the house with the light. By this time one of the children, a boy of about ten, was interested, and he dressed to come out and guide us to the office. He took us to the same door as before and we knocked again. Another volley of abuse. Natasha was splendid. She said she was a high government official and she had a car full of ambassadors stuck on the road. If the door wasn't opened there would be 'bolshoi scandal'. The only reply was more abuse.

'Very well', said Natasha, 'we shall go to the chairman of the village.'

The boy was enjoying all this and he readily agreed to take us. It was midnight by this time and we stumped up the village street and knocked on the window of another dark house. The same explanations were shouted through the window. No, we couldn't see the chairman because he was away, but this woman would come down the road with us and wake the deputy chairman. So the party of us—Natasha, the boy, the chairman's wife, one or two neighbours, and myself—felt our way down the dark street to another house, and knocked on another dark window. The deputy-chairman was a woman, very efficient. She immediately grasped the situation. She would come down with us to force the office caretaker to open the door and let us into the telephone. So, neighbours and all, we went back to the office of the Soviet.

We knocked again. There came the same volley of abuse from inside. Then the deputy-chairman spoke. There was a scraping and the door opened. They forgot what we had come about and fell into a long discussion on citizenship, all talking at once. After a few minutes I said to Natasha, 'Please remind them that we want to telephone

Moscow. They can go on with their argument while we are 'phoning.'

'Unfortunately', they said, 'the key to the telephone room isn't here: it's lost'.

'There's another at the house of Comrade X', said the small boy; and he ran off to fetch it.

'Anyway', said the caretaker, 'the telephone is out of order.' The key was brought. The telephone room was opened. But the telephone did not work.

The only remaining hope was for Natasha and me to stop one of the heavy lorries that occasionally rumbled past into Moscow. She waited for one and waved, while I stood behind a bush, so that it shouldn't look like a hold-up. Several lorries passed us and would not stop. But eventually Natasha stopped one and told the ambassador story again. Yes, they would take us into Moscow. One of the men got out and sat in the cold at the back so that Natasha and I could ride in the driver's cabin. The driver had the quiet dignity which marks the good Russian workman. He dropped us at the National Hotel. We exchanged cigarettes, shook hands, and he drove on. It was about 3 a.m.

The rest of the story covers nearly another two hours but it can be recorded quickly. We got a spare car (we had to 'milk' another car to get enough petrol for the trip). We reached the Buick some time before dawn, to find Nikolai asleep, the Agronomist asleep, and the British official comforting the Hungarian film star. We left Nikolai to look after the Buick, and drove the others back to Moscow. Shortly before we dropped the Agronomist, he displayed the premonitory symptoms of a lecture, and on the sidewalk he delivered himself of a charming, if somewhat ill-timed, speech about agriculture in the Moscow oblast; and he graciously thanked us for coming to see the farm. I bowed and apologised for the inconvenience caused him by the shortcomings of my chauffeur. And we shook hands some half-dozen times. At the National Hotel we dropped

the film star, who postponed her trip to Kiev and stayed in bed for nearly a week afterwards. And in Gorki Street we dropped Natasha, the VOKS official whose poise and resource had made a very jolly night out of what might have been an uncomfortable experience. She is much too efficient for VOKS.

Chapter 8

SCIENCE AND THE PUBLIC

THE NEWSPAPERS; HERO-WORSHIP OF SOVIET SCIENTISTS; POPULAR SCIENTIFIC LITERATURE; SCIENTIFIC FILMS; POPULAR LECTURES ON SCIENCE; SCIENCE USED AS PROPAGANDA; SOVIET INVENTIONS

'SOVIET RULE', wrote Édouard Herriot, 'has bestowed on science all the authority of which it deprived religion.'[1] In this penetrating remark Herriot sums up accurately the place of science in modern Russia. Because this cult of science lies at the foundation of Soviet rule, it is a task of Soviet rulers to keep science constantly before the people. In Russia the popular scientist is not regarded as a decayed poor relation of the scientific worker. His craft is an essential activity in the Socialist state. He writes not to amuse the people but to bring them enlightenment. Accordingly the technique of presenting science to the public is in Russia a very serious matter, which engages the attention of the Academy and the interest of the Government. Most people in Russia are not very well educated, and it is therefore very instructive to study how the Government makes them and keeps them 'science conscious'.

It can be said without fear of contradiction that nowhere else in the world, not even in America, is there such a widespread interest in science among the common people as there is in Russia. Science is kept before the people through newspapers, books, lectures, films, exhibitions in parks and museums, and through frequent public festivals in honour of scientists and their discoveries. There is even an annual 'olympiad' of physics for Moscow schoolchildren, in which they solve problems in a competition on the lines of a 'knock-out' tennis tournament; and then

[1] *Eastward from Paris*, 1934, p. 215.

gather in the University to see experiments illustrating the answers, and to applaud the prizewinners as they take their prizes from the hands of some famous physicist.[1] The benefits of this scientific progaganda are, first, that it enables the citizen to understand what the State is trying to do for him and, second, that it dispels superstition and prejudices. 'The struggle against superstition', said one writer recently, 'constitutes an integral part of the general struggle for our happy future.'

This emphasis on popular science is admirable. For the man-in-the-street who reads little beside his newspaper, it takes the place of the comic strip, the latest unsolved murder, and the divorce cases: all of which are absent from the Soviet daily. But in Russia science, like most other subjects, is sometimes tendentious. Its very popularity makes it a useful weapon of propaganda; and accordingly some scientific articles are written not only to convey information but also to satisfy the craving for self-congratulation which is one of the infirmities of modern Russia. Many articles make claims for Soviet scientists which they themselves would be the first to deny; a few ambitious and irresponsible scientists have taken advantage of the importance of popular science in Russia to boost their own work even when it is unsound or trivial;[2] and a few unscrupulous scientific journalists have made absurd national claims for Soviet science. These extravagances should not be taken too seriously; though it is hard to ask for indulgence from the English, who are so accustomed to taking their superiority for granted that they are frankly puzzled when another great nation indulges in fulsome propaganda to proclaim its accomplishments. The rest

[1] See account in *Pionerskaya Pravda*, 17.4.45.

[2] A notorious example of this is the claim made by Lysenko and his supporters for the value of vernalisation in Russia. The foreigner is led to believe that vernalisation of cereals is widely practised and very successful. In point of fact it is not being used at all on cereals except for experimental work, and never was successful in large-scale work.

of this chapter contains an expansion of these comments, together with a brief account of the ways in which science is kept before the people through newspapers, books, films, and lectures.

The Newspapers

All Soviet newspapers are published by the Government, and although some latitude is allowed to editors, the general trends of policy are dictated from above. A newspaper like *Pravda* or *Izvestiya* is quite standardised in format. There are four pages. The first page carries a leading article, undoubtedly inspired from the Kremlin; the latest crop of decrees; the most important current political events in Moscow; more often than not, a photograph of Generalissimo Stalin alone or in some group; and at the top the old slogan 'Proletariat of every country, unite!' The second page contains important articles on policy, sometimes two or three columns long; not streamlined according to the technique of the modern popular-press but rather like *The Times* of the last century. The third page carries similar articles, including news about official events, and also some criticism—criticism of books, of a new play, or of the failure of some enterprise to fulfil the plan. The fourth page carries the foreign news, carefully selected, and sundry other articles. There is a uniform buoyancy about the articles. They all have the double purpose of informing the reader and maintaining national *esprit de corps*. There are shouts of bravado about over-fulfilling the plan; hearty self-congratulation on the wisdom and equity of Soviet foreign policy; exhortations to greater production; bitter criticism of the shortcomings of organisations which are not working in 'the bolshevik way'; but, of course, never any criticism of the Government. Here are a few titles of articles on science:—'Huge Vitamin Reservoir'; 'On the Eve of the Spring Sowing'; 'Festival of Armenian Academy of Sciences';

'Mechanics of Long-range Planning'; 'Let Us Develop the Attack on Drought'; 'The Battle for Moisture is the Battle for the Harvest'. Criticism of competitors provides occasional light relief. Thus, under the title 'Sloppiness and Culture', *Pravda* criticises the editorial staffs of various provincial newspapers for allowing gross errors in the use of words to appear in their papers. Several papers are mentioned by name and accused of making grammatical errors; and one paper made the sad mistake of using the word 'fauna' instead of 'flora'[1] The use of scientific patter in the sales talk of advertisements is, of course, absent in Russia. But the newspapers do enlist the jargon of science to support their campaign for better-quality consumer goods. For instance, a newspaper may carry a highly critical article about the low quality of textiles, cigarette-holders, razor-blades, shoe polish, rubber teats for babies, and the like, concluding with the portentous statement 'Laboratory analyses . . . have shown that certain enterprises are systematically violating the technology of production'.[2]

However, it is not what is put in, but what is left out of a Soviet paper which is its most striking feature. Legal proceedings are not reported unless they are (like the Polish trials) staged for propaganda purposes. Scandals, divorces, accidents, and gossip about society, are not reported. There is a bare chronicle, when it is deemed necessary, of the Government's official engagements; but nothing about Stalin's holidays or excursions; nothing about what Mrs. Molotov wore at a reception; nothing about who is staying in the Moskva Hotel. And the reader would look in vain for a sports page, racing tips, comic strips, advertisements (except for theatre and concerts), an astrology column, or a crossword puzzle. It is not light reading, especially if the reader is reading it on the sidewalk and the newspaper is stuck on a wall, as often happens. There is one light touch: the dailies commonly carry what are called

[1] *Pravda*, 2.3.45. [2] *Pravda*, 12.3.45.

feuilletons, cruel and ironic, which pillory some unfortunate citizen who has not lived up to Soviet ideals. For instance, the director of the zoological garden at Sverdlovsk 'a certain Shubin, about once a week visits the supply organisation at Sverdlovsk to collect supplies for the animals. The crocodile in the zoological gardens gets very few of these supplies. The "lion's share" goes to Vedenskaya and Sadetskaya, who work at the gardens, while the lion receives sufficient only to feed a white mouse. Owing to these systematic robberies ninety animals have died in the Sverdlovsk zoo recently. Shubin, the director, exchanged a yak for four pigs required for his own needs and three silver foxes disappeared recently to be made into stoles.... It is said that at night the jackals in the Sverdlovsk zoo complain that they are anything but jackals compared with their director.'[1]

Such is the tone of the press from which the Soviet citizen receives his daily pabulum of education in science. Every day there is something about science:—A three-column article praising Tsitsin's new wheat hybrids; a series of articles on 'The Earth and the Universe'; description of a new scientific institute for the synthetic and perfumery industries, to 'rationalise methods of production of synthetic goods, scent, soap, and eau-de-cologne'; flight of the scientific balloon 'U.S.S.R.W.R. 70' to do work for the hydrometeorological service of the Red Army on atmospheric electricity; a chain of new seismological stations on Kamchatka; a review of scientific publications of the Kirghiz Academy of Sciences; 'The Glorious Feat of Soviet Metallurgists in the Patriotic War'. Every expedition, to study the Soviet Arctic, to measure cosmic rays in the south, to collect fossils from Siberia or folk-music from Tadzhikstan—and there are scores of such expeditions every summer—is written up in the papers in a way likely to appeal to the intelligent man. The 1945 total eclipse of the sun, for instance, was followed closely

[1] *Izvestiya*, 18.7.45.

in the press. Four months before the eclipse, the Soviet citizen read in his paper that an expedition would be sent to watch it; Professor Mikhailov would measure the Einstein effect, and Academician Papalexi would study changes in the ionosphere.

The numerous saints' days of the Church are largely replaced by a vigorous hero-worship of living and lay-canonisation of dead scientists. The eightieth birthday of a living scientist and the centenary of a dead one are occasions for solemn public meetings and laudatory newspaper articles. On the hundredth anniversary of the birth of the biologist Mechnikov (15 May 1945) all papers burst into reverent praise. They expatiated on the difficulties Mechnikov experienced under the Tsarist regime, and they coupled his name with Pasteur, Lister, and Koch. With the October revolution, they said, Mechnikov's dream for Russia was fulfilled. There were solemn meetings in his birthplace, Panasovka, and in Moscow, Leningrad, Kharkov, and Odessa. The Council of People's Commissars announced that a monument to Mechnikov would be put up in Moscow, and plaques in Kharkov and Leningrad; two Mechnikov medals and prizes would be awarded; the All-Union Society of Microbiologists would henceforth be called after him; the People's Commissariat of Health would publish a collected edition of his works and his biography; and the Cinema Committee would prepare in 1946 a scientific popular film devoted to his life and work.

The canonisation of Ilya Ilyich Mechnikov was accomplished. Every school child heard about it. It was on the radio. It was read in the club-rooms of collective farms and in the framed newspapers on the sidewalks of cities. By the evening of 15 May 1945 millions of Russian citizens knew Mechnikov's name, and could have told you that he worked on phagocytes and immunity, comparative embryology, and the problem of old age. And in the same way, millions of Russian citizens know about Timiryazev and photosynthesis, Michurin and plant breeding, Lobachevsky

and non-Euclidian geometry, Mendeleev and the periodic table. It is parrot knowledge, of course, not understanding. But it generates a deep respect for science and scientists. It 'builds them up', to use the jargon of advertising. And it attracts into science the brightest minds in Russia.

The newspapers act in another way as recruiting sergeants for science; for when a distinguished scientist dies, they report in detail the financial benefits paid to his widow and family. In October 1945 the engineer A. N. Krylov died. It was immediately announced that, in addition to the endowment of fourteen Krylov scholarships and other memorials, Krylov's wife would receive a personal pension and yearly assistance to the value of 50,000 roubles. Two months later the botanist V. L. Komarov died. Various memorial scholarships were immediately founded, and in addition it was announced that his wife would receive a pension and a grant of 70,000 roubles, and his sister a pension and a grant of 30,000 roubles.

All this hero-worship of the scientists in the newspapers is admirable, and it explains why the ambition of many a young Russian is to be a scientific research worker; not a doctor, or a lawyer, or a soldier. Only it is sometimes abused for stupid nationalistic propaganda: examples of this abuse are given later in this chapter.

Popular Scientific Literature

In 1941 C. H. Waddington made a brilliant excursion into popular science [1] and he dedicated his book to his own reputation as a 'sound' young man which (he supposed) would perish when the book appeared. Scientists in Britain who write about popular science still have to apologise: in Russia an indiscretion as successful as Waddington's would place its author (in the critical reviews) alongside Homer and Lucretius, the 'founders of

[1] *The Scientific Attitude*, Penguin, 1941.

scientific-artistic literature'. The writing of 'scientific-artistic' literature in Russia is a high calling. Science is necessary to the people, they say, and the people to science: therefore a common language must be found for the two.

It was Maxim Gorki, the literary giant of the Revolution, who gave this impetus to popular science. And there is today a school of Soviet writers who specialise in the blending of science and fiction, particularly for children. Orlov writes engineering romances. Kostykov writes books on scientific espionage, such as *The Magic Lamp*. Nemtsov has written a novel about radio. There are novels about the Arctic, complete with anemometers, instruments for hydrographic survey and portable radio stations. The hero measures magnetic fields in inconceivable cold and makes chloride titrations of water from under the ice floes. There are novels about bridges and canals, chemists and doctors. The themes are not love and war, but 'man's constant struggle to wrest from Nature her secrets'. 'The drama of invention, scientific research, and mathematical calculations' said one critic,[1] 'is no less intense in its emotion than the drama of love and jealousy as presented . . . in *Othello* and *Hamlet*.' Jules Verne, Conan Doyle, and H. G. Wells are translated in enormous editions. There is even a Section of Scientific Imaginative Literature attached to the Praesidium of the Union of Soviet Writers.

Popular scientific literature is not only imaginative. There are dozens of illustrated pamphlets on science by eminent scientists. Academician Keller, for instance, has written an illustrated pamphlet of thirty-eight pages on evolution, which sells for sixty kopeks and is printed in editions of 200,000 copies. Stoletov's pamphlet on 'Why are Plants Green', sells at fifty kopeks, also in editions of 200,000. Leybson, who works in Pavlov's institute near Leningrad, has written a delightful children's book on early chemistry, which contains an account of the founding

[1] *Literaturnaya gazeta*, 10.3.45.

of the Royal Society of London. It is 150 pages long, with pen-and-ink sketches, and is published in a modest edition of 15,000 copies. Perhaps the most interesting of these popular science books has the unpromising title 'Guide to the Zoo Park', by Shklyar.[1] It is a book about the work of the Young Naturalists' League, which for two decades has inspired young people to take up biology as a career. Many research biologists in Russia today received their first stimulus from Shklyar and his associates; and through a sort of 'mass observation' of animals, the Young Naturalists have added substantially to our knowledge of animal behaviour.

Scientific Films

A Government film studio, known as 'Voentechfilm' is responsible for making scientific films. There is great enthusiasm in Russia over scientific films, but the enthusiasts have to contend with two major difficulties. The first is that the technique of production is still backward in Russia. The second is that cinemas are primitive, flea-ridden, and so overcrowded that long queues form for all performances; and projection equipment in clubs, schools, and universities, is very scarce. Nevertheless there is plenty of enterprise, and the plans are ambitious and are being steadily fulfilled. There is a periodic Festival of Scientific and Historical Films. In 1945 it lasted for a month. Films were shown which illustrated the life and work of Pavlov and Michurin. Other films described advances in medicine and agriculture; and others were about the geography of the Soviet Union. A notable natural-history film in 1945 was 'The Law of Eternal Love' in which the star rôles are played by a family of foxes, and the theme is the maternal instinct in animals and birds. Another nature film, 'Insects of the Sun', deals excellently with the life of the bee. Other scientific films released in 1946 were 'The Eclipse of the

[1] Published in 1935.

Sun and Moon' and Jack London's 'White Fang'; and there were new films on the botany of the Urals and the archaeology of Uzbekistan.

Popular Lectures on Science

The scene is a boot factory in Moscow. In the sewing room are some 200 girls and children working at machines. At one end, on a board some forty square feet in area, are pinned brightly coloured diagrams to illustrate the Ptolemaic, Copernican, and Newtonian theories of the solar system, and the theory of relativity. A course of lectures on astronomy is being held in the factory, and the diagrams are changed from week to week. The attendance is said to be a hundred per cent.

Another scene: this time the Sokolniki Park of Rest and Culture, in Moscow, on a Sunday in August. In an open-air auditorium surrounded by birch trees sits a large crowd. A frail little man in a white beard is talking about the Academy of Sciences, his voice harshly amplified by a noisy crackling public-address system. It is Academician Keller. He winds up his address with a paean of praise for the 'deep concern of Comrade Stalin and the Bolshevik Party in science'. He is followed by a young excitable man, who proclaims how, through 'our Soviet genetics', man can now control the heredity of crops. This is Professor Turbin, who holds the Chair of Genetics at Leningrad. There are other addresses: on the mineral wealth of the U.S.S.R.; on Soviet mechanics; and an exhibition of lifelike models to illustrate the origin of man. For this is 'A Day of Meeting the Scientists'. Crowds of Muscovites have come up to Sokolniki Park on the Metro to see in the flesh the men they have read about. And the day ends with a grand concert relayed all over the park while the people walk among the trees.

Lectures are very much the fashion in the Soviet Union. They are held in parks, clubs, factories, collective farms,

public halls, and even concentration camps. They are not only the fashion: they are genuinely popular. It is reported that on 30 June 1946, the day before the first atomic bomb test, 100,000 people listened in the Gorki Park of Rest and Culture to a lecture on the use of atomic energy in industry. The Lecturing Bureau of the Committee for Higher Education organised in the last three years over 9,000 lectures, to audiences altogether exceeding three million, and issued 120 pamphlets about their lectures. In the Ryazan Oblast, which has eleven towns and some 1,600 villages, there is a panel of 1,400 lecturers on scientific propaganda; and a similar story could be told of a dozen other districts. The august Academy of Sciences has a Council for Scientific Technical Propaganda. In 1944, it is reported, this Council organised 9,000 scientific lectures and sent 280 scientists, in 'brigades' to bring enlightenment, in the form of popular science talks, to the areas newly liberated from German occupation.[1] So seriously are lectures taken that both their presentation and content are subject to constant scrutiny, and if necessary, to sharp criticism. Thus, writing of popular lectures to servicemen, Major Mironov complained: 'Lecturers frequently appear before their audience without even a written note. More frequently, the text of their lecture has not been inspected beforehand by . . . the chief of the propaganda department'.[2]

Nationalistic Propaganda

For the Soviet eagerness both to deliver and to listen to lectures, one has nothing but admiration. And there is no doubt that the 'masses' are becoming science-conscious in a way not known before in Russia, or indeed anywhere

[1] *Trud.*, 19.7.45.

[2] *Red Star*, 14.10.45. The technique of Russian lecturers is not very attractive. Almost invariably they read from a script; therefore to lecture without notes, far from being a sign of a good lecturer, is a sign of a bad one.

in the world. Unfortunately this widespread interest in science is sometimes abused, and the worst abuse is the practice of entrepreneurs in science of exaggerating the accomplishments of Russian scientists, as a means of inflating national pride. This practice has recently taken the form of surprising claims that many important discoveries originated in Russia. It may surprise the English reader to hear that the world is in debt to Russia for the invention of the radio, the aeroplane, the steam engine, the steam turbine, the electric arc, electric lighting, jet propulsion, rocket propulsion, the helicopter, and penicillin; that Lomonosov demolished the phlogiston theory before Lavoisier, and that Timiryazev was the first to explain the process of photosynthesis in green leaves.[1] Yet if Soviet scientific journalism is to be believed, all these claims are established beyond any doubt. Let us examine a couple of them.

In October 1942, Professor Z. V. Ermolyeva began working on the extraction of penicillin from moulds. She isolated a concentrate which was named Soviet penicillin. As far as one can judge, Soviet penicillin comes from the same species of *Penicillium*, and has the same properties, as penicillin in other countries; and it is probable that Ermolyeva would be the first to confirm this judgment. But the publicity agents took the matter out of her hands, and her work is acclaimed as a major discovery. In March 1945 Ermolyeva was awarded a Stalin Prize and the Order of Lenin. Her photograph appeared in the paper as 'the discoverer of the new drug penicillin'.[2] An article a couple of days later, entitled 'A Woman who Fights Microbes', described the properties of Ermolyeva's 'greatest discovery . . . Soviet penicillin', and adds 'Penicillin was also discovered by Fleming'.[3] In the next

[1] The claims for Lomonosov and Timiryazev are mentioned in an article on 'Natural Scientific Materialism in Russia' by G. Vasetski, in *Bolshevik*, No. 15, 1944, and in sundry other places.

[2] *Pion. Pravda*, 6.3.45. [3] *Pravda*, 8.3.45.

week Ermolyeva, 'discoverer of Soviet penicillin', was made vice-chairman of a Penicillin Commission.[1]

On 7 May 1945 the Bolshoi Theatre was packed with a distinguished audience, including the heads of diplomatic missions in Moscow, to celebrate the fiftieth anniversary of the invention of the radio by A. S. Popov.[2] On the stage there sat scientists, marshals, admirals, commissars, leaders of the Party, and Popov's daughter. It was announced that in future 7 May would be celebrated as the 'Day of the Radio', and Popov's name would be perpetuated by a monument in Leningrad, a gold medal to be awarded for inventions in the field of radio, plaques in the various houses where Popov lived and worked, an annual wireless exhibition in Moscow, a biography, a book entitled *Fifty Years of Radio*, and by naming a museum after Popov. In addition his two daughters were granted 500 roubles a month and his grand-daughter 500 roubles a month until she has completed her higher education.[3]

What is the strength of Popov's claim to have invented the radio? Priorities for inventions are difficult enough even for experts to determine, and even when the descriptions are in English. So it is with diffidence that the present writer suggests that there is some substance in Popov's claim; perhaps not enough to justify the shrill festivities in the Bolshoi Theatre, but certainly enough to justify a revision of our views about the claims of Marconi. All authorities, including those in Russia, agree that the foundations for radio were laid by Hertz and other physicists contemporary with him. And there seems no reason to doubt that Marconi was responsible for the commercial exploitation of radio. But who transmitted the first message between two points by Hertzian waves? The credit for this is ascribed to Marconi. The Russians dispute it. The earliest published evidence for Marconi's

[1] *Vech. Mos.*, 11.3.45.
[2] All Moscow papers, 8.5.45.
[3] *Vech. Mos.*, 29.3.45; *Pravda*, 3.5.45.

claim is his application for a British patent, dated 2 June 1896.[1] At this time Popov in St. Petersburg was certainly working independently on the same lines as Marconi. In April 1895 he read a paper on his work to the physical section of the Russian Physical and Chemical Society, and a fuller account of his work was published in the Society's journal in January 1896. According to this account Popov erected a primitive aerial, which he called a 'thunder-tapper' (*grozomechnik*) connected with a device which received and recorded discharges of atmospheric electricity. With this apparatus Popov not only received records of distant thunderstorms; he also detected waves propagated over five kilometres by an assistant with a vibrator. If Popov merely received discharges of atmospheric electricity before June 1896 it cannot be claimed that he 'invented wireless'. But if he did in fact transmit and receive Hertzian waves over a distance of five kilometres, and publish that fact in January 1896, then it can be claimed that he used Hertzian waves to transmit a message before Marconi lodged his patent application. In the *Electrician* for 10 December 1897, there is a letter in English from Popov, in which he gives a summary of his article published in Russian twenty-three months earlier. His letter contains both claims: that he had recorded thunderstorms and received waves propagated by a vibrator five kilometres away. How, then, has Popov's claim been overlooked? The answer to this question is to be found in one of the standard books on wireless telegraphy, by J. A. Fleming.[2] Fleming prints a translation of parts of Popov's paper, but he omits that part of Popov's report which refers to the transmission and receiving of waves over five kilometres, and he dismisses Popov's claim by saying: 'it is beyond question that the use he made of his apparatus was not the

[1] British patent specification No. 12039, 2.6.1896.

[2] *The Principles of Electric Wave Telegraphy and Telephony*, 4th edition, London, 1919. I am indebted to Professor V. A. Bailey of the Department of Physics, University of Sydney, for this information.

communication of intelligence to a distance, but for studying atmospheric electricity'. It appears that Fleming's account is quite misleading; and that before 1896 Popov, independently of Marconi, did transmit and receive Hertzian waves, and published an account of it six months earlier than Marconi. Popov, having 'suffered deeply from lack of encouragement on the part of stupid Tsarist officials', died in 1906 at the age of forty-six. In the perspective of history, the dispute seems academic; but it is symptomatic of the extreme sensitivity of the Russians in matters of national prestige in science; and it is a warning to the historian of science not to dismiss all Soviet claims on the grounds that some of them are nonsense.

The reader must make do with nothing more than a brief enumeration of some of the other claims.

In 1944 there was published a history of aviation in the U.S.S.R. up to 1914. The book was reviewed in the journal *Oktyabr* for 1944 (No. 12). It claims, among other things, that the first aeroplane was built and tested by A. P. Mozhaiski, 'twenty years before the brothers Wright'. The tests could not have been very successful, because other Soviet historians believe that the first flight on Russian soil was not made until 1910. The first real successes achieved with the helicopter were in Russia by the pupils of Zhukovski in 1910 to 1912. The parachute was invented by a Russian actor, G. Kotelnikov, and was demonstrated by him in Paris.[1] The electric arc is commonly believed to have been invented by Davy, who presented his battery, of 2,000 pairs of plates, to the Royal Society in 1810. 'Without any reflection on Davy's merits', says Professor Zvorikin gently, 'it is, nevertheless, necessary to state that priority in inventing the electric arc belongs to the Russian scholar . . . V. V. Petrov.' Petrov published a paper on the electric arc in 1803, and, what is more, his battery contained 4,200 pairs of plates.[2] Polzunov built the first

[1] *Novi Mir*, No. 10, 1944. [2] *Trud.*, 9.3.45.

steam engine in 1765.[1] Zalesov built the first steam turbine. And 'Russian Sun'—the first electric lamps—were burning before Edison's time, having been invented by A. N. Lodygin in 1873.

The present writer offers no opinion as to the validity of these claims. Some of them, such as the claim for Popov, may be genuine, for Russian science was isolated from the stream of western culture in those days. What is significant for the present theme is that the claims, right or wrong, are played up by propagandists in a very distasteful way. Science is enlisted to inflame the people with a pretentious nationalism. It does not come naturally to the Russians to be nationalistic in this childish way, and to their credit it should be said that some eminent Russians are ashamed of this sort of propaganda, and very few of them are impressed by it. It has been said that the Russian 'lacks the cement of hypocrisy'. It is very true; and it explains how Russian propagandists can strive to maintain the status of Soviet science among foreigners by stories which no Russian scientist would dream of taking seriously.

[1] *Trud.*, 20.2.45.

Chapter 9

CONCLUSIONS

IN the foregoing eight chapters I have set out some of the facts and painted in some of the background of science in the U.S.S.R. Russia has endowed science with the authority of religion. Science has a privileged place in the school curriculum; it is the main subject of study in hundreds of institutes of higher education; its plans are woven into the plans for national development; it is admitted to the highest councils of the country; it is generously endowed with money and men. Science carried out with an eye to its practical application is specially encouraged. It follows that the solution of short-term problems arising out of social needs is for many scientists a short cut to preferment; but the scientific worker who is strong-minded enough to stick to academic problems is allowed to work as he wishes, and does not have to sacrifice the quality of his work for quick results.

The good Soviet scientist has an impressive knowledge of foreign work in his field of research. He is as up-to-date and balanced in his knowledge as a British scientist. Usually he reads French, German, and English with ease. He is serious-minded and clear-headed; ready to admire good work and ready to condemn bad work; ready to admit that Russian science is backward in some fields and able to demonstrate without boasting that it leads in other fields. He is surprisingly internationally minded, considering he has been cut off from nearly all contact with foreigners and forbidden to travel outside Russia. He would, in brief, find himself completely at home in a laboratory in any British country. And he is, without doubt, Britain's keenest ally in our efforts to break down government-imposed barriers and remove government-inspired suspicion in the Soviet Union.

What conclusions can be drawn about the quantity and quality of scientific work in the U.S.S.R.? The quantity, to judge by the number of scientific papers published and the number of workers employed, must be immense. It is idle to guess at the precise number of scientific workers in the U.S.S.R., because no reliable figures are available. Thus Turin recently [1] gave the number as 32,617 in 804 institutes, but this is certainly an under-estimate. What is certain is that in all technological work (*i.e.*, scientific work in the various Commissariats) the limiting factor is not money or laboratory space, but men. It is idle, too, to compare the quantity of scientific work done in Russia with that done in, say, the United States, because in Russia all scientific work is in government departments whereas in the United States a good deal of scientific work is done privately by industry, and its results are not disclosed.

As to the quality of scientific work in the U.S.S.R., it is possible to be more specific. My own tentative opinions are as follows.

(*a*) The view held by some enthusiasts in British countries, that Soviet scientists by virtue of their organisation and planning are able to accomplish wonders impossible outside the Soviet Union, is nonsense. Notwithstanding all propaganda to the contrary there is no profound difference between the organisation of science in the Soviet Union and its organisation elsewhere. On paper every scientist works to a plan and every problem has a bearing on some need of the State. On paper it is all as the Webbs so clearly describe it;[2] the State Planning Commission (Gosplan) delegates the responsibility of planning science to the Academy, and the Academy publishes very elaborate plans which are co-ordinated with the master organisations of Gosplan. The President of the Academy even releases a summary of the plan to the press. But the actual situation is that, in the Academy at any rate, the plan interrupts

[1] *The U.S.S.R.—an Economic and Social Survey*, London, 1944.
[2] *Soviet Communism*, 3rd edition, 1944, p. 771.

rather than aids scientific research. Since it begins at the level of the scientific worker, and is carried upwards, the plan is not a menace; it does not threaten the worker with problems imposed from above. No one is likely to criticise it except the director, because as the scores of plans converge at higher levels, they become less intelligible to the committees who scrutinise them. The plan is, therefore, harmless, but it would be a mistake to suppose that it is responsible for the successes of Soviet science. These are due to the brilliance of Soviet scientists, not to their organisation.

(*b*) The Soviet Union may be presumed to have the same proportion of first-class scientists per head of population as any other civilised country. These scientists are concentrated largely in Moscow and Leningrad. They are given every encouragement and facility to work. Their work is important and worth careful attention, as it would be whatever their nationality and in whatever country they worked. They are given a very high social status and they are free from anxiety about money for themselves or for their institutes.

(*c*) Although there is not likely to be any greater proportion of first-class scientists in the Soviet Union than elsewhere, there is a much greater dilution of first-class men by men of poorer quality. In endowing so many institutes so generously the ambitions of the planners of Soviet science have outrun the human material available to them. One advantage of the parsimonious policy of some capitalist governments toward pure scientific research is that only comparatively high-class men bother to take up scientific research as a career. This deterrent is absent in the U.S.S.R. Scientific research ranks above clinical medicine or the law as a profitable career. It would be thought reactionary to adopt a go-slow policy in expanding a scientific institute; so institutes have to take what they can get in the way of staff, and the first-class men are surrounded by, and considerably hampered by, large numbers of workers of

indifferent quality. This state of affairs is not, of course, peculiar to the U.S.S.R. It is common in the graduate schools of American and even some British universities. It seems to be an inevitable consequence of the generous endowment of research. The significant point is that the Soviet Union is not exempt from it, and the planners of Soviet science have not found a way to cure it. The result of it is that the *average* quality of scientific work in the Soviet Union is low, simply because there is an excess of low-quality workers; and the achievements of Soviet science are no more than the achievements of a small band of first-class scientists.

(*d*) Two qualifications must be added to these three opinions about the quality of Soviet science. The first is that certain kinds of research requiring team-work can be done better in the U.S.S.R. than elsewhere, and, under a good leader, remarkable results can be obtained. Thus in the fields of exploration, surveys of vegetation and soils and minerals, mapping, and so on, the achievements of the U.S.S.R. in so short a time are remarkable and greatly surpass anything the British Empire has done. These achievements are due simply to the fact that the Government finances such enterprises without question, and, apart from the leader, they do not need first-class scientists.

The second qualification is that the U.S.S.R. has built a much firmer bridge between pure science and practical application than exists in other countries; so that a new chemical process, or a new crop variety, or a new technique, can be readily tried out on a 'pilot-plant scale'. In fact there is too great a temptation to work on lines which lead to quick results; for if the results of scientific research are shown to have practical application there is a bonus for the inventor (the originator of a new potato variety may get a prize of 50,000 roubles), and even coveted medals and decorations. The Stalin prizes for science, of which a hundred are awarded each year, very often go to the man or woman who has concentrated on utilitarian research.

To sum up. A great quantity of scientific work is done in the Soviet Union because a great number of workers has been mobilised to do it. The quality of scientific work, in the Soviet Union as elsewhere, is no better than the quality of the worker. There are many first-class men whose work is important, but the general level of accomplishment is lower than one might expect, because of the greater dilution of first-class men by hack workers. Nevertheless science in the Soviet Union is ambitiously planned, well endowed, vigorous, and healthy; and even if its record over the last twenty-five years is not astonishing, its promise for the future can hardly be overestimated. Soviet scientists are eager for contact with their foreign colleagues. They follow British science closely, and they admire it. It is clear that for the present the Soviet Government does not intend to allow its scientists to travel abroad freely, nor to allow foreign scientists to visit Russia except on its own terms. By a simple decision the Kremlin could solve overnight the problem of scientific liaison between the Russians and the rest of the world. But there is no sign that this simple decision is coming, and some signs that it will not come. Meanwhile let us remember that the only large group of Russians who are obliged by their profession to remain constantly in touch with British thought are the scientists. Among them there is a great reservoir of goodwill toward us. This goodwill may be of critical importance in holding Britain and Russia together over the next few years.

APPENDIX 1

ORGANISATION OF THE ACADEMY OF SCIENCES OF THE U.S.S.R.

(i) *Central Administration:* Moscow, Bolshaya Kalujskaya 14.

There is a Praesidium of twenty-one members. The President is the physicist S. I. Vavilov, and the Secretary is N. G. Bruevich. The main library is in Leningrad, at the old headquarters of the Academy, Universitetskaya, nab. 5.

(ii) *Principal Institutes, Laboratories, and Commissions under the Academy.*

(A) *Division of Physico-Mathematical Science.*

Secretary: A. F. Joffe.

	City.	*Director.*
Physical Institute	Moscow	S. I. Vavilov
Institute of Physical Problems	Moscow	P. L. Kapitsa
Physico-Technical Institute	Leningrad	A. F. Joffe
Crystallography Institute	Moscow	A. V. Shubnikov
Mathematical Institute	Moscow	E. M. Vinogradov
Institute of Theoretical Geophysics	Moscow	O. U. Schmidt
Seismological Institute	Moscow	V. F. Bonchkovsky
Hydrophysical Laboratory	Moscow	V. V. Shulekin
Principal Astronomical Observatory	near Leningrad	G. N. Neumin
Institute of Theoretical Astronomy	Leningrad	M. F. Subbotin
Committee for Meteorites	Moscow	V. G. Fesenkov
Laboratory for Construction of Astronomical Instruments	Leningrad	D. D. Maksutov
Society for Radiophysics and Radio Technique	Moscow	N. D. Papalexi
Astronomical Society	Moscow	A. A. Mihailov
Commission for Spectroscopy	Moscow	G. S. Landsberg
Commission for Acoustics	Moscow	N. N. Andreev
Commission for Cosmic Rays	Moscow	A. I. Alichanov
Commission for the History of Physico-mathematical Science	Moscow	A. N. Krilov
Commission for Application of Physics to Mineral Surveys	Moscow	O. U. Schmidt
Astrophysical Commission	Moscow	V. A. Ambartsumian
Society for Astronomo-Geodesy	Moscow	A. A. Mihailov

(B) *Division of Chemical Sciences.*

Secretary: A. N. Bach.[1]

Institute of General and Inorganic Chemistry	Moscow	I. I. Chernyaev
Institute of Organic Chemistry	Moscow	A. N. Nesmeyanov
Colloid-Electrochemical Institute	Moscow	A. N. Frumkin
Institute of Chemical Physics	Moscow	N. N. Semenov
Radium Institute	Moscow	V. G. Khlopin
Hydrochemical Institute	Novocherkask	P. A. Kashinsky

Laboratory of Geochemical Problems	Moscow	A. P. Vinogradov
Commission for Analytical Chemistry	Moscow	A. P. Vinogradov
Commission for Isotopes	Moscow	V. G. Khlopin
Commission for Macro-Molecular Structure	Moscow	A. F. Joffe
Commission for the History of Chemistry	Moscow	A. E. Arbuzov
Commission for publishing the works of Mendeleev	Leningrad	A. E. Favorsky
Mendeleev Chemical Society	Moscow	A. N. Bach [1]

[1] Died May 1946.

(C) *Division of Geological-Geographical Sciences.*

Secretary: V. A. Obruchev.

Institute of Geology	Moscow	D. S. Belyakin
Institute of Frozen Earth	Moscow	V. A. Obruchev
Institute of Geography	Moscow	A. A. Grigoriev
Dokuchaiev Soil Institute	Moscow	L. I. Prasolov
Laboratory of Oceanography	Moscow	P. P. Shirshov
Laboratory of Vulcanology	Moscow	A. N. Zavaritsky
Laboratory for the Study of Lakes	Leningrad	D. V. Nalivky
Laboratory for Hydrogeological Problems	Moscow	F. P. Savarensky
Laboratory for Aerial Methods	Moscow	P. I. Stepanov
Pacific Ocean Committee	Leningrad	—
Committee for Studying the Quaternary	Moscow	V. A. Obruchev
Karpinsky Geological Museum	Moscow	V. I. Krijanovsky
Society of Soil Science	Moscow	L. I. Prasolov
Geographical Society	Leningrad	L. S. Berg

(D) *Division of Biological Science.*

Secretary: L. A. Orbeli.

Komarov Botanical Institute	Leningrad	B. K. Shishkin
Timiryazev Institute of Plant Physiology	Moscow	A. N. Bach [1]
Forestry Institute	Moscow	V. N. Sukachev
Bach Biochemical Institute	Moscow	A. N. Bach [2]
Institute of Microbiology	Moscow	B. L. Isachenko
Genetical Institute	Moscow	T. D. Lysenko
Institute of Cytology, Histology and Embryology	Moscow	A. A. Zavarzin
Zoological Institute	Leningrad	E. N. Pavlovsky
Institute of Evolutionary Morphology	Moscow	E. E. Schmalhausen
Palaeontological Institute	Moscow	A. G. Vologdin
Pavlov Physiological Institute	Leningrad	L. A. Orbeli
Institute of Physiology	Moscow	L. S. Stern
Principal Botanical Garden	Moscow	N. V. Tsitsin
Laboratory for Physiological Chemistry	Moscow	Y. O. Parnas
Laboratory of Helminthology	Moscow	K. I. Skriabin
Laboratory for the Physiology of Speech	Leningrad	S. M. Dobrogaiev
Laboratory for Remote Hybridisation	Nemchinovka	N. V. Tsitsin
Laboratory for the study of the Evolution of Microorganisms	Moscow	N. F. Gamalea [3]

Laboratory for Photosynthesis	Moscow	A. A. Richter
Laboratory for Capillary Microscopy	Leningrad	B. V. Perfiliev
Sebastopol Biological Station	Sebastopol	V. A. Vodyanitsky
Murmansk Biological Station	near Murmansk Yaroslavl Oblast	M. S. Zernov
Barok Biological Station Commission	Moscow	V. N. Sukachev
Commission for the History of Biology in the U.S.S.R.	Moscow	H. S. Koshtoyantz
Commission for the Study of Filterable Viruses	Moscow	N. F. Gamalea
Commission for Physiological Optics	Moscow	L. A. Orbeli
Society of Physiologists, Biochemists, and Pharmacologists	Moscow	L. A. Orbeli
Society of Helminthology	Moscow	K. I. Skriabin
Entomological Society	Leningrad	E. N. Pavlovsky

[1] Acting Director, N. A. Maximov. A. N. Bach died in May 1946.
[2] Acting Director, A. I. Oparin.
[3] Gamalea is one of the three honorary Academicians. He is in his eighty-eighth year.

(E) *Division of Technical Science.*

Secretary: I. P. Bardin.

Institute of Energetics	Moscow	G. M. Krijanovsky
Institute of Combustible Minerals	Moscow	S. S. Nametkin
Institute of Metallurgy	Moscow	I. P. Bardin
Foundry Institute	Moscow	A. A. Skochinsky
Institute of Mechanical Engineering	Moscow	E. A. Chudakov
Institute of Mechanics	Moscow	B. G. Galerkin
Institute of Automatic and Tele-mechanics	Moscow	V. I. Kovalenkov
Section for the Scientific Study of Transport Problems	Moscow	V. N. Obraztsov
Section for the Scientific Study of Water Economy	Moscow	F. P. Savarensky
Section for the Scientific Study of Electrical Communications	Moscow	B. A. Vvedensky
Section for the Scientific Study of Electro-welding	Moscow	V. P. Nikitin
Committee for Technical Terminology	Moscow	A. M. Terpigorev
Committee for the History of Technology	Moscow	B. N. Yurev

(F) *Division of History and Philosophy.*

Secretary: V. P. Volgin.

Historical Institute	Moscow	B. D. Grekov
Institute for the History of Material Culture	Moscow	B. D. Grekov
Institute for the History of Art	Moscow	I. E. Grabar
Institute of Ethnography	Leningrad	S. P. Tolstov
Institute of Philosophy	Moscow	V. I. Svetlov
Institute for the History of Natural Science	Moscow	
Institute of Pacific Studies	Moscow	E. M. Zhukov

Commission for compiling a History of the Great Patriotic War	Moscow	G. F. Alexandrov
Commission for the History of the Academy of Sciences of the U.S.S.R.	Leningrad	S. I. Vavilov
Museum of the History of Religion	Leningrad	Y. P. Frantsev
Archives of the Academy of Science	Leningrad	G. A. Knyazev

(G) *Division of Economics and Law.*

Secretary: E. S. Varga.

Institute of World Economy and World Politics	Moscow	E. S. Varga
Economics Institute	Moscow	P. A. Romov
Institute of Law	Moscow	I. P. Traynin

(H) *Division of Literature and Languages.*

Secretary: I. I. Meshchaninov.

Institute of World Literature	Moscow	V. F. Shishmarev [1]
Institute of Literature	Leningrad	P. I. Lebedev-Polyansky
Institute of Language and Thought	Leningrad	I. I. Meshchaninov
Institute of Russian Language	Moscow	S. P. Obnorsky
Institute of Oriental Studies	Leningrad	V. V. Struve [2]
Committee of Dialectics	Moscow	—
Commission for Slavonic Studies	Moscow	N. S. Derjavin

[1] Under this institute are the Gorki Archives, and the Gorki, Pushkin, and Tolstoy museums.
[2] Branch at Moscow.

(I) *Miscellaneous.*

	City.	*Director.*
Committee for Co-ordinating the Scientific Work of the Academies of the Republics	Moscow	—
Committee for Scientific and Technical Propaganda	Moscow	V. N. Obraztsov
Editorial and Publications Committee	Moscow	—
Commission for Publishing Popular Scientific Literature	Moscow	S. I. Vavilov
Commission for Museums and Archives	Moscow	P. I. Stepanov
Academy of Sciences Press	Moscow	I. A. Martinov
Laboratory for Scientific Photography and Cinematography	Moscow	V. K. Borshchenko

(iii) *The following is a list of 'filials' of the Academy:*

Azerbaijan Filial, Baku.
Kazakstan Filial, Alma-Ata.
Kirghizia Filial, Frunze.
Tadzhikistan Filial, Stalinabad.
Turkmenistan Filial, Ashkhabad.
Urals Filial, Sverdlovsk.
West Siberian Filial, Novosibirsk.

Beside these filials, there are entirely independent Academies in Ukraine (Kiev), Belorussia (Minsk), Armenia (Erivan), Georgia (Tbilisi), Lithuania (Vilna), Uzbekistan (Tashkent), Latvia (Riga), Tallinn (Estonia).

(iv) *Number of scientific workers in the Academy of Sciences as on* 1.1.1945.

Division.	Category of Worker. Academicians and Corresponding Members.	Doctors and Professors.	Candidates of Science.	Others.	Total.
Physics and Mathematics	49	90	141	195	475
Chemistry	23	77	181	204	485
Geology and Geography	17	55	148	188	408
Biology	26	160	208	128	522
Technology	52	64	170	206	492
History and Philosophy	25	95	128	101	349
Economics and Law	11	42	62	41	156
Literature and Language	27	51	79	59	216
Miscellaneous	—	11	15	29	55
Filials, etc.	16	103	313	593	1025
Auxiliary Institutions	—	5	25	—	30
	246	753	1470	1744	4213

(v) *Journals published by the Academy of Sciences.*

There is not space here to give a complete list of the journals and other publications from the Academy; nor is it necessary, since the Science Museum, South Kensington, London, has a complete list. But the following particulars are of general interest and are worth including.

(*a*) *Journals.* There are (1946) 43 journals. Three of these are in languages other than Russian, namely: *Acta physiochimica, Comptes rendus de l'Académie des sciences de l'U.R.S.S.*, and *Journal of Physics.* Three journals (including the *Historical Journal*) were published in 1945, but are absent from the 1946 list of journals; and there are two new journals, namely: *Fiziologicheski Zhurnal* (Physiological Journal), and *Sovietskoe gosudarstvo i pravo* (Soviet State and Law).

(*b*) *Non-periodic publications.* There are (1945) no less than 71 non-periodic publications, new numbers of which are issued from time to time. Most of these are called '*Trudi*' and they contain papers and monographs too long for publication in the ordinary journals. All of these are in Russian.

(*c*) *Publications in several volumes.* The Academy is issuing monumental publications on many subjects, of which new volumes are issued as they are ready. There are nineteen series of these publications.

They cover: World History; History of English Literature; History of Russian Literature; History of the U.S.S.R.; History of Philosophy; History of French Literature; Materials for a History of the Flora and Vegetation of the U.S.S.R.; Mineralogy of the Urals; Minerals of the U.S.S.R.; Non-metallic Minerals of the U.S.S.R.; Sketches for the Geology of Siberia; Palaeontology of the U.S.S.R.; Petrography of the U.S.S.R.; Vegetation of the U.S.S.R.; Stratigraphy of the U.S.S.R.; Fauna of the U.S.S.R.; Flora of the U.S.S.R.; Chrome ores of U.S.S.R.

APPENDIX 2

ORGANISATION OF AGRICULTURAL RESEARCH IN THE U.S.S.R.

THERE are some 965 scientific research institutes, stations, and experiment farms (known as 'points') under the Ministry of Agriculture. Most of these are controlled by the Chief Scientist, whose address is: Sadova Spassnaya, Moscow. A few institutes are under the control of the All-Union Lenin Academy of Agricultural Science, whose headquarters are at 21B Haritonevsky, Moscow. It is impossible to enumerate here all the 965 centres for agricultural research. In the following list they are grouped according to the subjects of research and the names are given of a few of the principal institutes.

Branch of Agriculture.	*Number of Institutes, Stations, 'Points', etc.*	*Names of Principal Institutes.*
Cereal Culture.	139	All-Union Scientific Research Institute for Plant Breeding, Leningrad. All-Union Selection-Genetical Institute, Odessa. All-Union Scientific Research Institute of Grain Economy, Saratov. All-Union Scientific Research Institute of Northern Grain Economy, Moscow.
State Selection Stations for Cereals.	62	Moscow State Experiment Selection Station for Grain Culture, Nemchinovka.

Branch of Agriculture.	*Number of Institutes, Stations, 'Points', etc.*	*Names of Principal Institutes.*
Oil Crops.	17	All-Union Scientific Research Institute of Oil Culture, Krasnodar.
Sugar Beet.	76	All-Union Scientific Research Institute of Sugar Beet Industry, Moscow.
Cotton.	43	All-Union Scientific Research Institute of Cotton Culture, Tashkent.
Flax.	17	All-Union Scientific Research Institute of Flax Economy, Torzhok.
Hemp.	13	All-Union Scientific Research Institute for Hemp, Glukov.
Tobacco.	15	All-Union Scientific Research Institute for Tobacco, Krasnodar.
Rubber.	10	All-Union Scientific Research Institute for Rubber Culture, Moscow.
Drug Plants.	13	All-Union Scientific Research Institute for Drug Plants, Bitsa.
Ethereal Oils.	17	All-Union Scientific Research Institute for the Culture of Ethereal Oils, Pushkino.
Fruit and Wine.	122	Central Genetical Fruit Laboratory of I. V. Michurin, Michurinsk. All-Union Scientific Research Institute of Fruit and Berry Culture, Michurinsk.
Sub-Tropical Crops.	43	All-Union Scientific Research Institute of Tea Production and Sub-Tropical Cultures, Anascule-Maharadze. Batum Botanical Garden, Batum.
Vegetables and Cucumbers.	17	All-Union Scientific Research Institute for Vegetable Economy, Tekstilshiki.
Potatoes.	32	All-Union Scientific Research Institute for Potato Economy, Malachovka.

Branch of Agriculture.	*Number of Institutes. Stations. 'Points', etc.*	*Names of Principal Institutes.*
Fodder.	5	All-Union Scientific Research Institute for Fodder, Lobnya.
Bast Materials.	5	All-Union Scientific Research Institute of Bast Materials, Moscow.
Agro-Forest-Amelioration.	30	All-Union Scientific Research for Agro-Forest-Amelioration, Moscow.
Fertilisers, Agrophysics, Microbiology.	16	All-Union Scientific Research Institute for fertilisers, agro-technique, and soil science applied to agriculture, Moscow (VIUAA). Leningrad laboratory of VIUAA, Leningrad. All-Union Scientific Research Institute of fertilisers, insecticides, and fungicides, Moscow. All-Union Scientific Research Institute of Agro-physics, Leningrad. All-Union Scientific Research Institute of Micro-biology, Leningrad.
Plant Protection.		All-Union Scientific Research Institute for Plant Protection, Leningrad.
Cattle and Sheep.	57	All-Union Scientific Research Institute for Animal Breeding, Moscow. Scientific Institute for Acclimatising and Hybridising Cattle, Askanya-Nova.
Horses, Camels, Donkeys.	6	All-Union Scientific Research Institute for Horse Breeding, Moscow.
Reindeer; Animal Husbandry and Agriculture of the Extreme North.	29	Scientific Research Institute of Polar Agriculture, Animal Husbandry, and Trade Economy, Leningrad.
Sheep and Pigs.	5	All-Union Scientific Research Institute for Sheep Breeding, Voroshilovsk.

Branch of Agriculture.	*Number of Institutes, Stations, 'Points', etc.*	*Names of Principal Institutes.*
Sheep and Pigs	5	All-Union Scientific Research Institute for Pig Breeding, Poltava.
Poultry.	10	Scientific Research Institute for Poultry, Zagorsk.
Rabbits and Furred Animals.	13	Scientific Research Institute for Rabbits, Udelnaya.
Beekeeping.	8	Scientific Research Institute for Beekeeping, Butova.
Silk Production.	15	Scientific Research Institute for Silk Production, Tbilisi.
Veterinary Science.	35	All-Union Scientific Research Institute in Experimental Veterinary Science, Kuzminsky. State Institute of Veterinary Dermatology, Moscow.
Hydrotechnics, Reclamation of Swamps and Moors.	44	All-Union Scientific Research Institute for Reclamation, Moscow. Northern Scientific Research Institute for Reclamation, Leningrad.
Mechanisation and Electrification.	14	All-Union Scientific Research Institute for Mechanisation and Electrification of Agricultural husbandry, Pliushchevo. All-Union Scientific Research Institute of Machine Building, Moscow.
Agricultural Economics.	16	Central Experiment Station, Moscow.

APPENDIX 3

RULES FOR SCHOLARS (INTRODUCED 1943)

Every scholar is obliged:—

1. To master his studies with persistence and determination so that he will become a well-educated and cultured citizen and be of the greatest possible use to his Soviet fatherland.
2. To study industriously, attend classes punctually, and be on time for the opening of school.
3. To obey the instructions of the director and teachers of the school without objecting.
4. To arrive at school with the necessary text-books and writing materials, and to make every preparation for the lesson before the teacher's arrival.
5. To come to school clean, neatly dressed, and with tidy hair.
6. To keep his place in the class clean and tidy.
7. To enter the class and take his place immediately after the bell, and enter and leave class during a lesson only with the teacher's permission.
8. To sit straight during lessons without lounging or leaning on his elbows, to pay attention to the teacher's remarks and the answers of other pupils, not to talk, and not to attend to other things.
9. To stand up and greet the teacher or the director of the school when they enter or leave the class.
10. To stand up when answering the teacher. To hold himself erect and to sit down only with the teacher's permission. To raise his hand when wishing to answer or to ask the teacher a question.
11. To put down in a diary or special notebook the work which the teacher sets for the next lesson, and to show this entry to his parents. All homework should be done by oneself.
12. To be polite to the director and teachers. On meeting the teachers and director in the street to greet them with a polite bow and to raise one's cap if a boy.
13. To be polite to his seniors. To behave decently and modestly in school, in the street, and in public places.
14. Not to use abusive and coarse expressions, not to smoke, not to play games for money and similar things.
15. To look after school property. To take care of his own belongings and the belongings of his comrades.
16. To be attentive and courteous to old people, to small children, to the weak and to the sick. To give up his place to them, and to give them every possible help.
17. To obey his parents. To help them, and to look after his younger brothers and sisters.

18. To observe cleanly habits in rooms. To keep his clothing, footwear, and bedroom tidy.

19. To carry his ' Pupil's Card '. To look after it carefully, not to give it to anyone else, and to show it when the director or teachers ask for it.

20. To uphold the honour of his school and of his class in the same way as his own honour.

Breach of these rules will lead to punishment, going as far as expulsion from the school.

APPENDIX 4 (*a*)

FULL SYLLABUS OF MIDDLE SCHOOL BIOLOGY, 1944

Explanatory Note

Aims of Course.

The teaching of biology in the middle school has the following aims:—

(1) To give the knowledge of morphology, anatomy, physiology, and systematics of plants and animals necessary for the understanding of the fundamental laws of the development of organisms and for the subsequent assimilation of the basis of human anatomy and physiology and the fundamentals of Darwinism.

(2) To show the student the material nature of the life processes of plant and animal organisms and to interpret the scientifically materialistic conception of the world as against the idealistic approach to living nature. To exhibit concretely the relationship of the structure of an organ and its function and the relationship of the organism to its surroundings. To indicate the individuality of a living organism, to give the conception of a cell and cellular structure of the organism; to acquaint the student with the elementary phenomena of comparative anatomy, embryology and palaeontology; and to give an elementary idea of the historical development of the organic world.

(3) To show how man can act on plants and animals and how, based on the knowledge of the laws of development of the organism, he conquers the nature of plants and animals and what immense prospects open in this direction in influencing the organism in the rearing of plants, animals, fish, and in other branches of agriculture. To show the success of science in the work of Michurin, Lysenko, and scientific investigational institutions of the U.S.S.R.

In the course of the biology studies the teacher should:—

(1) Give the student the fundamental ability to observe and experiment with plants and animals and teach him to record his observations in drawings and notes, to make collections, systematically training the student for independent work.

(2) Train the student to work with text-books and to assimilate the material covered.

(3) Teach the intelligent application of knowledge acquired in the study of botany and zoology to agricultural practice, and the knowledge in anatomy and physiology to the care of health and hygiene.

Method of Study.

The study of biology in the middle school is carried out in the following sequence: after a general elementary course in natural history covering subjects in inorganic and organic nature and beginning in the fifth class, separate biological sciences are introduced: Botany, Zoology, Human Anatomy and Physiology, Fundamentals of Darwinism.

(1) The biology course begins with botany, that is with the anatomical and physiological review of the plant organism and the fundamentals of plant systematics. The latter is presented from a historical point of view.

Botany is taught in the fifth class and in the first half of sixth year. The study of the fundamental physiological processes is connected with the elucidation of the scientific principles of plant-rearing practice. The course in Botany should help to equip the student with agricultural knowledge and technique. The student's attention should be directed to the local natural resources and their utilisation (preparation by the students of medicinal raw materials of local wild-growing, edible, fibre-, dye- and tannin-producing plants).

(2) The Zoology course follows the Botany and gives the fundamentals of natural classification of the most important animal groups (the second half of the sixth year and the seventh year). This course gives the comparative anatomical and physiological material suitable for the understanding of the student and also palaeontological and general biological material emphasising the idea of Evolution. For better assimilation of the ideas of the historical development of the organic (and in particular the animal) world, the course covers the most important animals, from this view, which at the same time are most easily available for experimental study, beginning with the simplest and finishing with the primates. The course in zoology throws light on a series of most important practical problems of agriculture and husbandry, *e.g.*, biological principles in the fight against parasites and agricultural

pests, scientific principles in the breeding of fish, poultry, animals, and the production of new breeds of farm animals.

The Zoology course should turn the student's attention to insects as carriers of infectious diseases and the methods of combating these.

(3) In the eighth class a course in human anatomy and physiology is given.

Anatomical and physiological peculiarities of man are regarded in connection with his occupational activities. This course forms a natural continuation of the Zoology course and is largely based on the chemical knowledge acquired by the students in the seventh class. At the same time it gives the material necessary for a better assimilation in the following year of the problems of the origin of Man in the course on the fundamentals of Darwinism.

The course in human anatomy and physiology should deepen the student's knowledge of hygiene and of defence against chemical and bacterial warfare. In connection with this course it is also necessary to give the student a practical knowledge of first aid and the nursing of the sick and wounded.

(4) The significance of the integrating course in Darwinism studied in the ninth class is immense. If properly taught it is this course that creates the basis for a proper understanding of the dialectic materialistic interpretation of organic nature. The teaching of the fundamentals of Darwinism affords wide possibilities for showing the student the inter-relations of scientific theory and practice.

Method of Work.

For better and more permanent assimilation of biological knowledge the teacher must organise, in the course of a systematic and consecutive presentation of the syllabus material, laboratory experiments, the dissection of animals, observations under the microscope, observations of plants and animals *in vivo* in the school experimental plot and in Nature.

It is necessary for the teacher to organise a series of excursions in the field, into agricultural undertakings, museums. He must organise practical work on the school plot.

The teacher must be able to maintain a lively discussion during the lesson and to utilise most effectively the text-book and reference book for the deepening, widening, and fixing of the student's knowledge. He must also utilise the demonstration of experiments, collections, lecture specimens and specimens for the individual student's use, epidiascope, films, etc.

The teacher of biology will only be able to attain the aims of a biology course in Soviet schools by using diverse methods of instruction.

With the same end in view, it is necessary to stimulate independent work among the students by organising circles of young naturalists, experimental plant and animal breeders, Nature investigators; giving

them all possible help, and practising widely in the making of observations, experiments, and biological collections.

The independent observations and practical work of the students in the fields and the school plot, in the kolhoz or sovhoz during summer acquire great importance.

The teacher must plan ahead. Clear instructions for the carrying out of accessible and interesting observations during the summer help the student to become acquainted with natural phenomena which are often inaccessible for direct study at the school. During summer work in a kolhoz or sovhoz or a school plot the students can make many valuable observations, notes, drawings, and valuable collections. In the autumn it is necessary to integrate the summer work and the material which has been collected and studied and to present it as an exhibition of summer work. This material will be of use in the subsequent laboratory work. It is imperative to combat decisively the bookish, formal treatment of biology, separating the science from life and the Socialist construction.

The school motion-picture apparatus with films selected in accordance with the syllabus has a great significance in the student's training. The alloscope and the epidiascope should be widely employed for the demonstration of slides.

SYLLABUS—FIFTH CLASS

BOTANY (65 HOURS)

Introduction (1 hour)

Botany—science of the structure and life of plants. Botany service of Socialist construction.

(1) *General acquaintance with the flowering plant* (4 hours)

Organs of the flowering plant. Cellular structure of plants. Conception of the plant cell.

Laboratory work :

(*a*) Study of the external structure of a flowering plant.

(*b*) Acquaintance with the cellular structure of plants (work with magnifying glass).

Demonstration : The plant cell under the microscope (onion skin).

Excursion for a general acquaintance with flowering plants.

(2) *The Seed, its germination and the preparation of seeds for sowing* (10 hours)

The structure of the seeds of dicotyledons and monocotyledons.

Composition of seeds. Alteration of the seed and its parts during germination. Conditions necessary for germination.

Respiration of germinating seeds.

The determination of viability and purity of the sowing material.

Laboratory work :

(*a*) Structure of dicotyledon and monocotyledon seeds.

(*b*) Simple analysis of flower (separation of starch, protein and fat).

Demonstration :

(*a*) The results of germinating seeds under different conditions.

(*b*) Starch and protein in the cells of pea cotyledons (under microscope).

(*c*) Evolution of carbon dioxide by germinating seeds (experiment).

Excursion to the agricultural section of the local museum or to the experimental agricultural station, sovhoz, or kolhoz, to become acquainted with the cleaning and sorting of seed.

Classroom or home experiments:

(*a*) Germination of seeds and the determination of the percentage of germination.

(*b*) Observation of seedling development.

(3) *The Root. Nutrition of plants from soil, and treatment of soil in agriculture* (9 hours)

A brief description of soil as the medium for the development of green plants.

The external structure of the root. The root cap and root hairs. Types of root systems.

Internal structure of the root. Microscopic structure of the root hair, growth of the root.

Respiration of the root.

Supply of water and mineral salts to the root from the soil. Mineral substances containing nitrogen, phosphorus, and potassium. Conception of water cultures. The significance of fertilising and treatment of soils in increasing crops.

Laboratory work : Acquaintance with tap and fibrous roots.

Demonstration :

(*a*) Growth of the root tip.

(*b*) Cellular structure of the root: transverse section of the root, root hair, root cap (under microscope).

(*c*) An experiment showing the absorption of solutions through a membrane.

(*d*) Main types of mineral fertiliser.

Classroom and home experiments:

(*a*) Root growth.

(*b*) Additional nutrition of room plants.

(*c*) Care of water cultures and observation of their development.

(*d*) Transplantation of room plants (partial substitution of exhausted soil by fresh soil).

Excursion to the sovhoz or kolhoz, an experimental station or agricultural museum to study fertilising and treatment of soil.

N.B.—This excursion may be postponed and undertaken when reviewing the work done at the end of the year.

(4) *The Leaf. Nutrition from the air. Evaporation of water from the leaf* (12 hours)

Composition of the air—oxygen, nitrogen, and carbon dioxide; their properties.

The rôle of leaves in plant nutrition. External structure of leaves. The arrangement of leaves. Types of venation. Shapes of leaves. Cellular structure of the leaf. Chlorophyll grains. Absorption of carbon dioxide and evolution of oxygen in sunlight. Formation of starch in the leaf.

Evaporation of water by plant. Devices for the regulation of evaporation.

Respiration of plants and its differentiation from aerobic nutrition. The absence of special respiratory organs in plants.

Laboratory work:

(*a*) External structure of leaves.

(*b*) Types of venation.

(*c*) Simple and compound leaves. (Recognition of the main types of leaf.)

Demonstration:

(*a*) Cellular structure of the leaf (under the microscope).

(*b*) *Experiment:* Evolution of oxygen by a green plant in the sunlight.

(*c*) *Experiment:* The formation of starch by a leaf in the sunlight.

Classroom and home work: Experiment: Evaporation of water by leaves.

(5) *The Stem. The movement of water and nutritive substances along the stem* (9 hours)

The shoot. The arrangement and structure of the bud. The development of the shoot from the bud. The longitudinal growth of the shoot. Macroscopic structure of the stem of dicotyledons. Microscopic structure of the stem. The vascular bundle. The

growth of the shoot in girth. The significance of cambium. The peculiarities of stem structure of monocotyledons.

The rôle of the stem in the life of the plant. The ascending flow. The descending flow.

Modifications of stems. Tubers, corms, and bulbs. Their structure and biological significance.

Laboratory work :

(*a*) Study of the external structure of a branch, structure of the bud. Arrangement of buds, development of shoot from the bud; determination of the age of a branch.

(*b*) Macroscopic structure of the stem; bark, wood, and pith.

(*c*) Structure of the corm, tuber, and bulb.

Demonstration : Microscopic structure of the stem (longitudinal and transverse sections).

Classroom and home work :

(*a*) Observation of the opening of buds on branches.

(*b*) Observation of the development of the bulb and the tuber.

(6) *Reproduction of Flowering Plants* (10 hours)

Vegetative Reproduction : Reproduction by roots, stems, and leaves. Propagation of plants by cuttings, suckers, and grafts.

Sexual Reproduction : Structure of the flower. Pollination and fertilisation. Significance of cross pollination. The rôle of inflorescences. Insect- and wind-pollinated plants. Examples of self-pollination. Formation of the fruit. Types of fruit and the distribution of fruit and seed. Crossing and evolution of new varieties. I. V. Michurin and his work.

Laboratory work :

(*a*) Structure of the flower.

(*b*) Structure of the fruit.

Demonstrations :

(*a*) Germination of pollen.

(*b*) Technique of crossing plants (actual specimens, tables) and the results of the evolution of new types (specimens, models, tables).

Classroom and home work :

(*a*) Development of flower and fruit.

(*b*) Propagation of room plants by cuttings.

Excursion : Theme : "Biology of the flowering of early spring plants".

(7) *Growth and Development of Plants. Review of the Fifth-class Course* (9 hours)

The growth of plants. The influence on growth of temperature, moisture, light, and nutritive substances in the soil. Development of plants. Phases in the development of plants. Annual, biennial, and perennial plants : spring and winter plants. Regulation of plant development. Significance of yarovisation.

Demonstration : Living and herbarium specimens, also tables, of developing plants.

Classroom work : Observations and experiments illustrating the influence of temperature, moisture, light, and nutritive substances in the soil on the growth and development of plants.

Excursion : To the green-house, to observe the technique of the regulation of plant growth and development.

(8) *Practical Work on the Experimental Plot and Preparation for Summer Work*

(*a*) Compulsory practical work, carried out simultaneously by all the students in the class.

(i) Treatment of soil. Preparation of the plot. Addition of fertilisers to the soil.
(ii) Sowing of seed in the ground (or in hothouses).
(iii) Planting of seedlings in the ground.
(iv) Care of the plants: weeding and spacing of plants, cultivation of the top layers of the soil, watering.

(*b*) Practical work, carried out by groups or individually.

(i) The significance of seed quality in increasing crops: (*a*) sowing of choice seeds; (*b*) sowing of poor seeds (of the same plant).
(ii) The influence of the time of sowing on the crop: (*a*) early spring sowing of carrot (end of April, beginning of May for the middle belt of European Russia); (*b*) sowing of carrot twenty to twenty-five days later than normal.
(iii) Growing of plants (wheat, maize, beans) in soil boxes to illustrate the root system.
(iv) Experiments to illustrate the significance of the distribution of plants over the area on nutrition.
(v) Simplest experiments on additional nutrition of vegetables and other plants (*e.g.*, cabbage, sugar-beet, tomatoes).
(vi) Influence of fertilisers on the crop (in poor soils).
(vii) The significance of the leaf surface on the development of root vegetables (development of beetroot with leaves in the normal position and when tied in a bunch).

(viii) Various methods of vegetative reproduction.
(ix) Experiments on crossing two species of pumpkin with differently shaped fruit (or crossing of other plants).
(x) Phenological observations on the development of cereals and vegetables.
(xi) Experiments on yarovised winter wheat or rye.
(xii) Experiments on yarovisation of potatoes.
(xiii) Selection of cucumbers and tomatoes for seed.

Summer Work (1 hour)

Brief instructions on the plan of summer work and observations on the experimental plot jobs.

SIXTH CLASS

Botany (39 Hours)

Consideration of the results of the students' work on the experimental plot (4 hours).

Collection of harvest. Results of the experimental work (comparison of the harvest from experimental and control plots). Selection of seeds, tubers, roots; preparation of seed material for storage.

The most important families of flowering plants.

Conception of the systematics of flowering plants. Acquaintance with the representatives of the following families, their biological peculiarities and practical utilisation:—

Class I: Dicotyledons. Sub-class A: Dialypetalae. Families: (1) Cruciferae; (2) Rosaceae; (3) Leguminosae. Sub-class B: Sympetalae. Families: (1) Solanaceae; (2) Compositae.

Class II: Monocotyledons. Families: (1) Liliaceae; (2) Gramineae.

Laboratory Work: Structure of the flower and other organs of plants from the most important families (parallel with the study of each family).

Practice in the classification of flowering plants.

The basic groups of the plant world (17 hours).

(1) *Lower spore plants*

Bacteria: Minute, non-green plants. Their significance in agriculture. Causes of epidemics among humans and animals. The ancient origin of bacteria.

Algae: the most ancient group of green plants. Unicellular and multicellular algae. Structure, nutrition and reproduction of algae. Brown and red sea algae and their utilisation.

Fungi: Plants containing no chlorophyll. Pecularities of structure, nutrition, and reproduction of the lowest and highest fungi. Propagation of edible fungi. Fungous parasites and methods of combating them. Darnel and ergot.

Lichens: External forms and internal structure of lichens. Peculiarity of the organisation of lichen: symbiosis of algae and fungi. The rôle of lichens in nature.

(2) *Higher spore plants*

Mosses: The external structure of moss. The higher organisation of mosses as compared with lower spore plants. Reproduction and development of mosses. Peat mosses and the formation of peat.

Ferns: The most complex of the spore plants (possessing a stem with leaves and roots proper). Reproduction and development of ferns. Prehistoric ferns, mare's-tail and *Lycopodium*. Formation of coal. Plant fossils as witnesses of the antiquity of flora.

(3) *Flowering Plants*

Gymnosperms: The pine. Biology of the pine. Peculiarities of the flower structure. Gingko as a living witness of the ancient origin of gymnosperms.

Angiosperms: Flowering plants as the latest group in the plant world. The variation of angiosperms in adapting themselves to the surrounding conditions. The origin and development of the plant world. The origin of cultivated plants.

Laboratory work: Acquaintance with representatives of the various groups of plants (specimens).

Demonstration: Representative bacteria, algae, fungi, lichens, mosses, ferns, gymnosperms and angiosperms (microscopic and living and herbarium specimens).

Demonstration: Tables illustrating spore plants, gymnosperms and angiosperms.

ZOOLOGY (59 HOURS)

Introduction (3 hours)

Zoology—the study of animals. Division of the animal world into groups, types, classes, orders, species; incorporation of closely related species into a genus; incorporation of closely related genera into families, etc. (Concrete examples.)

The significance of a knowledge of zoology in the utilisation of the natural resources of the country.

I. *Phylum Protozoa* (6 hours)

General characteristics of protozoa as unicellular animals illustrated by the amoebae and *Paramecium*. Their structure and metabolism.

Conception of the protozoa as the borderline between animals and plants and their rôle in the establishment of the unity of the organic world (Green *Euglena*).

The rôle of protozoa in the formation of the sedimentary rocks (chalk and other limestones). Protozoa as causes of disease: dysentery amoeba, malaria parasite.

Demonstration:

(*a*) Living infusoria (*Paramecium*) under the microscope.

(*b*) Diagrams illustrating amoebae, *Paramecia*, and *euglenae*.

II. *Phylum Coelenterata* (4 hours)

General characteristics of the coelenterata illustrated by the fresh water hydra. Structure and life of the hydra; asexual and sexual reproduction; a strongly pronounced ability to regenerate parts of the body arising from the comparative homogeneity of its body.

Jellyfish and coral polyps; the relation of the limestone skeletons of the coral polyps to the conditions of existence in tidal regions. The rôle of the corals in the process of the earth's crust formation.

Laboratory work: Observation of the living hydra under the magnifying glass. Demonstration of diagrams and preparations of representative coelenterata.

III. *Phylum Platyhelminthes* (8 hours)

Earthworms—external and internal structure, life-cycle, their rôle in soil formation.

A brief review of parasitic flatworms (liver-fluke, pork tapeworm) and round worms, *Ascaris*: peculiarities of structure related to the parasitic habits; prophylactic measures against infection.

Laboratory work:

(*a*) Observation of the living earth-worm (method of locomotion).

(*b*) Dissection of earthworm.

Demonstration: Diagrams and specimens of the liver-fluke, the tapeworm *Ascaris* and earth-worm.

IV. *Phylum Mollusca* (4 hours)

Fresh-water mussel as a representative of the Phylum Mollusca. Its structure in relation to the life-cycle.

Commercial significance of oysters, mussels, etc.

Snails and slugs as agricultural pests.

Cuttlefish and octopodes. Their external structure, methods of locomotion, and way of life.

The rôle of the mollusc in sedimentary rock formation. Mollusc fossils (Ammonites and Belemnites).

Laboratory work: Acquaintance with the external appearance and dissection of the mussel.

Demonstration of living molluscs, specimens and diagrams.

V. *Phylum Arthropoda* (19 hours)

Cray-fish as the representative of the phylum Arthropoda; its external and internal structure related to the way of life. The more complex organisation as compared with the hookworm. The chitinous shell and segmented limbs as the characteristic of the crustaceans.

Division of the phylum into classes. General characteristic of the class Crustaceans. The significance of the lower Crustaceans (*Daphnia* and *Cyclops*) in the fishing industry.

The most important characteristic peculiarities of the class Arachnida and Myriapoda.

Class Insecta. External and internal structure of insects. Peculiarities of reproduction and development; insects with complete and incomplete metamorphosis.

Representatives of the most important groups of insects (external structure, way of life, diversity of adapting devices, practical significance, and method of combating pests): locusts as representative of the Orthoptera, parasitic lady-bird and bed-bug as representative of Hemiptera; cabbage-moth, silkworm as representatives of Lepidoptera, and the may-beetle as a representative of Coleoptera; house-fly and mosquito as representative of Diptera, the bee and the ant as representatives of Hymenoptera.

Points of similarity between Arthropoda and hook-worms.

Laboratory work:

(*a*) External examination and dissection of crayfish or a large insect (*e.g.*, cockroach).

(*b*) Acquaintance with representatives of the various types of insects (specimens).

Demonstration:

(*a*) Structure of crayfish or insect (diagrams).

(*b*) Representatives of the Arachnida and Myriapoda (specimens, diagrams).

(*c*) Variation of form and specialised devices of insects (living specimens, collections, diagrams).

(*d*) Practical significance of insects (living specimens, collections).

Classroom and home work: Stages of metamorphosis and mode of life of insects, their practical significance.

Excursion: Vegetable garden, garden or field for observation and collection of insects.

Practical work on the experimental plot or in the kolhoz. Combating agricultural pests.

VI. *Phylum Echinodermata* (2 hours)

The starfish as representative of the phylum; its external structure and mode of life. Water-carrying system as characteristic of the Echinodermata. Sea urchins and sea lilies, their external structure and mode of life. The twofold symmetry of their larvae.

Demonstration of specimens and diagrams.

Review of material covered in Botany and Zoology in the Sixth Class (11 hours).

Brief instructions on the plan of observations, collection of material, and gathering of collections during the summer.

SEVENTH CLASS

Zoology (66 Hours)

Introduction (4 hours)

Checking of the completion of the summer work. Repetition and brief review of material covered in the sixth class.

VII. *Phylum Chordata* (58 hours)

Introduction (2 hours)

Sub-phyla Cephalochorda and Craniata (Vertebrata).

Amphioxus as a form closely resembling the ancient ancestral chordates (invertebrate chordates).

General characteristics of the phylum Chordata : (1) notochord; (2) neutral tube; (3) gill clefts in adult forms and in embryos.

Demonstration: Specimens and diagrams of *Amphioxus*.

Class Pisces (9 hours)

Fresh-water perch—representative of the class. Division of the class into orders; the relative antiquity of these orders and their present-day distribution. Bony fishes as a later group, reaching it highest development in the present period of life on Earth.

Reproduction of fishes: connection between the quantity of spawn produced and the offspring-protection instinct. Industrial fishing

and its relation to the seasonal phases of fish life. Sea fishing and its development under the economic conditions in U.S.S.R. Fish breeding and fish ponds.

Laboratory work : External examination and dissection of a fish.

Demonstrations :

(*a*) Structure of the fresh-water perch (skeleton, diagram).

(*b*) Representatives of gill-cleft bearers, sturgeon and bony fishes (specimen, diagrams).

Classroom and home work : structure and methods of locomotion of fish.

Class Amphibia (6 hours)

The frog as representative of the class; its external and internal structure; comparison of the frog with the fish and its peculiarities connected with the change from water to land existence. Presence of water as a necessary condition of life for the frog; reproduction and development of the tadpole. The fish-like phase of tadpole development as indication of the historical process of the development of amphibians.

The division of the amphibians into tailed and tail-less; characteristics of these groups illustrated by individual representatives. The earliest amphibians and their relation to the earliest fishes. Conditions of their appearance. The imperfect adaptation of the amphibians to life on land.

Laboratory work : External examination and dissection of the frog.

Demonstrations :

(*a*) Structure of the frog (specimens, skeleton, diagrams).

(*b*) Representatives of the amphibians (living specimens, specimens, diagrams).

Classroom and home work : Habits and feeding of a frog or toad.

Class Reptilia (6 hours)

The lizard as representative of the class. Its external and internal structure in relation to its mode of life. Features distinguishing the reptiles from the amphibians and the former's higher organisation. Peculiarities of reproduction in reptiles related to their transition to life completely on land.

Division of the reptiles into orders and brief characterisation of the orders illustrated by individual representatives (lizard, snake, crocodile, turtle). Rudiments of limbs in legless forms (pythons) pointing to the descent of these animals from quadruped reptiles.

The descent of the reptiles from ancient amphibians. The flourishing and diversity of the ancient reptiles.

Reptiles, amphibians, and fishes as animals having no constant body temperature. Phenomenon of hibernation as an adaption to life conditions.

Demonstrations: Representatives of the reptiles (living specimens, specimens, skeletons, diagrams).

Class Aves (15 hours)

Peculiarities of external and internal structure related to mode of life (concrete example).

The egg, its structure. Development of the embryo in the egg. Rudiments of gill slits as evidence of the land vertebrates' descent from the ancient aquatic forms of life. The similarity between the bird and the reptile embryos pointing to their close relation.

Archaeornithes as the link between birds and reptiles.

Subclasses of keelless and keeled sternum. Diversity of the keeled sternum birds, their adaptation to various environmental conditions as the result of historical development.

Reproduction of birds. Biological significance of the colour and shape of eggs. (Birds having broods and clutches.)

Migration of birds and its biological significance. Protection and attraction of useful birds.

Origin of the domestic hen. Man's rôle in the breeding of various breeds of hens. Fowl-breeding in U.S.S.R. Incubation.

The most important birds (economically).

Laboratory work:

(*a*) Dissection of a bird (pigeon, crow or other bird).

(*b*) Structure of the feather.

Demonstrations:

(*a*) Structure of the bird (prepared specimens, skeleton, diagrams).

(*b*) Variety of birds (stuffed specimens, diagrams).

Excursion: To a poultry farm (where possible).

Class Mammalia (20 hours)

Peculiarities of the class as compared with other classes of vertebrates (concrete example); external and internal structure, reproduction and development. Variation in the forms of mammals related to their mode of life and environment altering in the course of historical development.

The earliest mammals and their probable descent from the ancient reptiles.

Order Monotremata or egg-laying mammals (platypus, echidna) as a group connecting mammals and reptiles.

Order Marsupialia (kangaroo) as a higher (compared with the Monotremata) degree of development of the mammals. Present-day

distribution of the marsupials and the variety of forms existing in Australia.

Order Eutheria. Specialisation of contemporary forms of the higher mammals.

Order Insectivora (hedgehog and mole) as members of a group closest to primitive higher mammals (weak differentiation of teeth, small size, plantigrade, five-toed feet).

Order Chiroptera as a specialised group close to the Insectivora (flying fox).

Order Rodentia as a group adapted to vegetarian nutrition. Rodents as agricultural pests and methods of combating them.

Order Carnivora. Biological peculiarities of the representatives of the main families comprised in this order : cats (domestic cat, tiger), dogs (wolf and dog), bears (brown bear), minks (mink or sable).

Orders Pinnipedia (seal) and *Cetacea* (blue or striped whale) as much modified and specialised descendants of the primitive carnivorous mammals.

Order Ungulata. Peculiarities of structure of the Artiodactyla (cow, pig) and the Perissodactyla (horse, rhinoceros). Teeth and stomach of the ruminant animals. Peculiarities of the Order Proboscidea (elephant).

Order Primates (monkeys, chimpanzees) and its peculiarities. Monkeys as climbing animals. Man as a member of the Order Primates. Features of the organisation of man distinguishing him from animals.

Domestic mammals. Origin of the most important domestic animals. Biological basis of taming; variety of species (breeds) of domestic animals. The significance of man's activity in taming animals and in producing new breeds.

The most important economic animals; their protection in U.S.S.R. Wild-animal breeding as a new branch of animal breeding.

Laboratory work : Dissection of a small mammal (rodent or cat).

Demonstrations :

(*a*) Structure of a mammal (specimens, skeletons, diagrams).

(*b*) Representatives of the various orders of mammals (stuffed specimens, diagrams).

Excursion : To the Zoological museum (in towns) or to an animal breeding farm (in the country).

Practical work : Care of domestic animals on kolhoz or on the school farm (where possible).

Conclusion and Review (4 hours)

The development of the animal world. Conception of the variation of animal types.

EIGHTH CLASS

HUMAN ANATOMY AND PHYSIOLOGY (66 HOURS)

Introduction (1 hour)

Human anatomy and physiology; their problems and significance.

(I) *The Cell and Tissues* (4 hours)

The similarity and difference in the structure of plant and animal cells. The rôle of the nucleus, protoplasm, and the cell wall in the animal cell. Division of cells.

The structure of animal tissues illustrated by the epidermal, connective (cartilage), and muscular tissues.

Brief data from the history of the conception of the cellular structure of organisms.

Laboratory work and demonstrations: Examination of cells and tissues under the microscope.

(II) *The Bone-muscle System* (6 hours)

The significance of the bone-muscle system in the organism.

The similarity in structure between the human and vertebrate skeletons.

Peculiarities of skeletal structure in man associated with erect posture.

Bone articulation. Structure of the joints. Composition and structure of bones. The rôle of cartilage. The joining of muscles to bones. Skeletal and visceral muscles. Contraction as the principal properties of muscles. Conception of muscular fatigue. The significance of rhythm and loading in muscular work. Conditions of the normal functioning of muscles. The influence of muscular activity on the muscular system and the rest of the organism.

First aid in fractures and dislocations.

Laboratory work and demonstrations:

(*a*) Skeleton or diagram showing the skeleton and muscles.

(*b*) Demonstration of burnt and decalcinated bone.

(*c*) Observations of the contraction of muscles in a prepared leg muscle of a frog.

(III) *Blood Circulation* (8 hours)

The significance of circulation in the organism. The history of the discovery of circulation.

Composition of blood. Plasma and serum. Transportation of carbon dioxide and oxygen in the organism. Red and white corpuscles and their significance. Blood-forming organs. The process of blood coagulation. Brief data on blood transfusion. Conception of

immunity. Significance of prophylactic vaccinations and therapeutic sera.

Structure of the heart. Arteries. Veins. Capillaries. Their significance. The pulse. A general scheme of blood and lymph circulation. Formation of lymph. Blood and lymph as media for cells and tissues. The work of the heart and the supply of blood to organs at rest and during various activities of the organism. The significance of heart-training. Fatigue of the heart and methods of preventing it. Conception of the first-aid technique in cases of wounding and haemorrhage.

Demonstrations:

(*a*) Preparation of a blood smear and its examination under the microscope.

(*b*) Observation of the movement of blood in the foot web of a frog (under the microscope).

(*c*) Demonstration of defibrinated blood.

(*d*) The alteration of the colour of blood under the influence of oxygen and carbon dioxide.

(*e*) Dissection of a mammalian heart.

(*f*) Demonstration of blood- and lymph-circulation diagrams.

(IV) *Respiration* (4 hours)

The significance of respiration in the organism.

Structure of the respiratory organs. Structure of the vocal apparatus. Mechanism and regulation of the respiratory movements. Artificial respiration.

Gas exchange in the lungs and tissues. Pulmonary ventilation and gas exchange during various activities of the organism.

Fresh air as one of the necessary conditions for health and productive work. Military poisons acting on the organism through the respiratory organs.

Laboratory work and demonstrations:

(*a*) Study of the structure of the respiratory organs of a mammal (specimens).

(*b*) Detection of carbon dioxide in exhaled air.

(*c*) Demonstration of a diagram of the respiratory organs.

(V) *Nutrition* (8 hours)

The significance of nutrition in the organism.

The similarity and difference in the structure of human and mammalian digestive organs. The principal groups of nutritive substances are proteins, fats, and carbohydrates. Water. Salts. Vitamins and their significance. Compositions of the main groups of foods. (Separate examples.)

The digestive glands. Changes in food during digestion in different parts of the alimentary canal. Conception of enzymes and of their rôle in digestion illustrated by ptyalin and pepsin. Bile. The passage of food through the alimentary canal. Absorption and assimilation of nutritive substances. The liver as a barrier.

The calorific value of food. The conception of adequate nutrition, and the food ration. Basic principles of the hygiene of nutrition. First aid in food poisoning.

Laboratory work and demonstrations:

(*a*) Dissection of a mammal or frog and examination of its digestive system.

(*b*) The digestive action of saliva and gastric juice.

(*c*) Demonstration of a diagram of digestive organs.

(VI) *Excretion* (3 hours)

Significance of excretion.

The end-products of metabolism and their excretion. Structure of the kidney. Formation of urine. The urinary tract. Structure of the skin. The skin as an excretory organ, its cooling function. The significance of the skin and perspiration. The basic rules of skin hygiene. Poisons acting through the skin.

Laboratory work and demonstrations:

(*a*) Dissection of an animal kidney.

(*b*) Examination of a transverse section of skin under the microscope.

(*c*) Diagram of the excretory organs and of the structure of the skin.

(VII) *The Nervous System* (15 hours)

Significance of the nervous system.

Structure of the nervous system: the central and the peripheral system. Similarity and differences in the structure of the human and animal (vertebrate) systems.

Conception of the neuron. Properties of nervous tissue. Structure of the spinal cord. Conception of the reflex. Reflex curves. Cerebro-spinal reflexes. The brain, mid-brain, and medulla oblongata.

The cerebellum and the large hemispheres.

Walking as an example of complex reflex action. Conception of the structure and function of the vegetative nervous system. The cortex of the large hemispheres of the brain as the organ of the highest nervous activity. Conditioned reflexes and their inhibition. Conditioned reflexes in animal life. Conditioned reflexes in humans. The individuality of the high nervous activity in man. Human consciousness as determined by social conditions.

The sensory organs and their rôle in the organism. The organ of vision. The retina as the afferent nervous apparatus. The organ of hearing. The rôle of the Corti organ. Organs of smell, taste, and sensation. Muscular activity.

Laboratory work and demonstrations :

(*a*) Demonstrations of the properties of nervous tissue illustrated by the neuro-muscular specimens.

(*b*) Demonstrations of the cerebro-spinal reflexes in a decapitated frog.

(*c*) Dissection of a mammalian eye.

(*d*) Demonstrations of diagrams of the nervous system, and of models of the ear, the eye, and the brain.

(VIII) *Internal Secretions* (4 hours)

Conception of the internal secretion glands. Hormones. The thyroid and the pituitary, sexual glands, suprarenals; their rôle in the organism. Experiments in the extirpation of endocrine glands in animals. Changes in the human organism, associated with the breakdown of normal functioning of the endocrines. Achievements in the study of endocrines and their practical significance in animal husbandry and medicine.

Demonstration of the thyroid and sexual glands of a dissected mammal.

(IX) *Human Metabolism* (8 hours)

General picture of metabolism. Assimilation and dissimilation the two mutually opposed aspects of the same process—that is, the exchange of substances and energy in the organism. The rôle of enzymes and hormones in metabolism. The principal methods of determination of metabolic rate. Irregularities in the organism associated with faulty metabolism. Nervous and humoral influences on metabolism.

(X) *Physiology of the Developing Organism* (3 hours)

The ovum. The spermatozoon. Fertilisation.

Intra-uterine life. The similarity between the first stages of development of the human and animal foetus. Physiology of the foetus.

Peculiarities of development in childhood and adolescence. Protection of mothers and children in the U.S.S.R.

Review and Summing-up (2 hours)

NINTH CLASS

FUNDAMENTALS OF DARWINISM (66 HOURS)

Introduction (2 hours)

The variety and unity of the organic world. The adaptation of organisms to the conditions of their existence. The conception of constancy of the organic world in the pre-Darwin era. Darwin—the propounder of the scientific evolutionary theory, showing the causes of organic evolution and arming us with the methods of governing it.

Excursion into the field or the museum to study the variety and adaptability of the organism.

(I) *The Life and Scientific Work of Darwin* (2 hours)

Main points in Darwin's biography. His characteristics as a scientist. Darwin's principal works.

Demonstrations:

(*a*) Darwin's portrait.

(*b*) A map of Darwin's travels.

(II) *The Basic Propositions of Darwin's Theory of the Origin of Species* (13 hours)

1. Variation and Heredity. Variation of cultivated plants and domestic animals: variation under natural conditions of existence. Determinate and indeterminate variation and its rôle in evolution. Heredity.

2. Artificial selection. The variety of breeds of domestic animals and cultivated plants. Selection and crossing. The creative rôle of selection in the creation of breeds.

3. Natural selection. The dependence of organisms on the surrounding organic and inorganic media. Adaptability to the surroundings as a necessary condition of survival. Natural selection as a historical process. Struggle for existence. The strengthening of natural selection as a result of the struggle for existence. Struggle for existence between members of different and the same species.

The adaptability of the organism to its environment as a result of natural selection.

Individual examples of the adaptation to environment: explanation of their origin in the light of the theory of natural selection; the relative character of the adaptation of organisms to their environment. The creative rôle of natural selection.

4. Variation of characteristics and formation of new species as a result of natural selection. Variation of characteristics, dying out of intermediate links, and formation of new species. The significance of geographical and biological (ecological and physiological) isolation in the process of natural selection. Species and Varieties.

The natural system as a reflection of organic evolution. The juxtaposition of the natural and artificial systems.

The significance of Darwinism in the struggle against the idealistic interpretation of 'expediency phenomena' and the theory of the constancy of species.

Appreciation of Darwin as a scientist and of Darwinism by the propounders of Marxism and Leninism.

Demonstrations:

(*a*) Collections of diagrams of individual variation of organisms.
(*b*) Diagrams of animal species.
(*c*) Specimens of various plants.
(*d*) Specimens, collections, and herbaria illustrating the adaptation of organisms to their environment.
(*e*) A scheme of species formation according to Darwin.
(*f*) Diagrams of plant and animal systematics.

Laboratory work: (*a*) Study of the variation of organisms.
(*b*) Study of the diversity of forms of adaptation to environment.

Excursion into the forests, the field, or to the museum, for the observation of results of the struggle for existence and natural selection.

(III) *The Basic Methods of the Study of the Organic World in the Light of Darwin's Theory* (11 hours)

Palaeontological methods. Fossils and the conditions of their preservation in the earth's crust. Subdivision of the geological history of the earth into eras and periods. Darwin's explanation of the incompleteness of palaeontological data.

Darwin's rôle in the development of palaeontology.

Mixed and intermediate fossil forms. (*Stegocephalion, Archeopteryx*, primitive reptiles). Palaeontological series of forms as illustrated by the Ungulata.

Comparative anatomical method. Homologous and analogous experiments. Rudimentary organs and their significance in the study of the evolution of species according to Darwin's theory.

Embryological method. The similarity of the first stages of embryonic development of animals, this similarity persisting to a later stage in animals closely related systematically. (Biogenetic Law of Müller and Haeckel.)

Examples of the inter-relationship of ontogeny and phylogeny.

Bio-geographical method. The present-day distribution of the flora and fauna as a result of the geological changes and the evolution of organisms.

The significance of natural isolation in the preservation of dying forms.

Demonstrations:

(*a*) Natural specimens and diagrams of fossils.

(*b*) Skeletons of the representatives of individual orders of vertebrates.

(*c*) Diagrams of rudiments and atavisms of animals and plants.

(*d*) Zoo-geographical map—diagrams.

(*e*) Diagrams of vertebrate embryos.

Excursion: During the study of the palaeontological data an excursion to the corresponding section of the local museum (in large cities to the special biological or geological museums).

(IV) *Russian Scientists—fighters for Darwinism* (18 hours)

K. A. Timiryazev, his life and scientific work. His rôle in the development and propaganda of Darwinism.

I. V. Michurin. Biographical data; principal methods of work. The most important varieties of plants introduced by him and his school.

T. D. Lysenko. The theory of phasic development of plants. Variation of the hereditary nature of plants based on the theory of phasic development (illustrated by the conversion of winter crops into summer ones and vice versa by vegetative hybridisation).

The agricultural significance of Lysenko's work.

Basic methods of selection in animal breeding in the U.S.S.R. illustrated by the breeding of the white Ukrainian pig, ramboul sheep of the Askanian type, mass inter-breeding of non-pedigreed stock and its significance.

Demonstrations:

(*a*) Diagrams, drawings, photographs, herbaria, and living specimens illustrating the work of Timiryazev, Michurin, Lysenko, Ivanov, and others.

(*b*) Drawings and slides of the All-Union Agricultural Exhibition.

(*c*) Portraits of Timiryazev, Michurin, Lysenko, and Ivanov.

Excursion: To the nursery of Michurin's selection plants or to the experimental plots in Kolhozes or Sovhozes, or to an agricultural exhibition.

(V) *The Origin and Development of Life on Earth* (8 hours)

Engels' view of the main stages in the development of matter from inorganic compounds to the primitive protein and cellular structures.

The rôle of natural selection in the origin of primitive forms of organisms.

The descent of plant and animal species from primitive unicellular organisms. The principal physiological distinctions between animal and plant organisms. A general review of the plant and animal world.

Demonstrations:

(*a*) Diagrams of the geological periods.

(*b*) Diagrams of genealogical trees of the plant and animal world.

(VI) *Origin of Man* (10 hours)

Man's position in the order Primates. The similarity and qualitative difference of man and the anthropoid apes. Characteristics of adaptation to tree life in the anthropoid apes (mainly Orang Outang and Chimpanzee).

Peculiarities of bodily structure in man associated with performance of work.

The evolution of man in the light of Engels' theory of work: The anthropoid apes of the Tertiary period and their geographical distribution.

The ape-men. *Pithecanthropus:* the volume and peculiarities of structure of the cranium. Erect posture.

Sinanthropus: (the 'Chinese man'), conditions of his life and his work. The Heidelberg man.

The significance of the *Sinanthropus* fossils as confirmation of Engels' exposition of the theory of work.

The Neanderthal man. The principal anatomical differences between the Neanderthal man and the modern man.

Neanderthal implements and the technique of their manufacture.

The Cro-Magnon man as the fossil form of the modern man.

Cro-Magnon implements and the technique of their manufacture.

The development of articulate speech.

Human Races: The qualitative differences between human and animal races.

The uniformity of the human races within the species. The similarity of the significant features: (foot, hand, large hemispheres of the brain); differences in the secondary characteristics. The uniformity of cultural development in all races.

The inadmissibility of extending the theory of natural selection to human society ('social Darwinism') and of the division of races into 'higher' and 'lower'. The anti-scientific, misanthropic race perversions of the fascist 'scientists'.

Demonstrations:

(*a*) Diagrams of the skeletons, muscles, and position of viscera in man.

(*b*) Natural human skeleton.

(*c*) Diagram of the lower and the higher apes (masks and skull impressions of anthropoid apes).

(*d*) Diagrams of the genealogical tree of man.

(*e*) Diagrams of prehistoric human ancestors.

(*f*) Drawings of representatives of the human races.

Excursion: To the local museum: to study the implements of prehistoric man. (In large cities—to the relevant sections of the biological museum or to the anthropological museum.)

Review of the course (2 hours)

A Representative Programme of Work on the Experimental Plot.

1. Spring sowing of yarovised and non-yarovised winter wheat or rye.
2. Spring sowing of winter or semi-winter varieties of wheat yarovised over different periods of time (from five to sixty days).
3. Spring and summer planting of potatoes.
4. Experiments on the daylight stage of plants of short (soybean, maize, millet) and long (radish, lettuce, mustard, etc.) day.
5. Experiments in grafting of annual plants (different varieties of potatoes, tomatoes, etc.).
6. Study of crossing techniques (intra-species and inter-species), illustrated by tomatoes, flax, pumpkin, wheat, etc.
7. Organisation of a Darwin plot and observation of the development and alteration of flora on it.
8. Experiments on the variation in results due to variation in the closeness and depth of sowing and planting of plants.
9. Homogeneous and heterogeneous sowings.
10. Work on the study of new forms of cultivated plants.
11. Experiments on artificial selection of botanical material.

APPENDIX 4 (*b*)

SYLLABUS OF MIDDLE SCHOOL MATHEMATICS, 1944

SUMMARY ONLY

CLASS 5

Arithmetic. 7 hours per week—229 hours in all (29 hours for revision). Revision of division and fractions taught in Class 4 (25 hours); vulgar fractions (65 hours); decimals (50 hours); percentages (30 hours); proportions (10 hours); direct and inverse ratios.

CLASS 6

6 hours per week, 196 hours in all (14 hours for revision).

Algebra. 3 hours per week in first ½ year.
4 hours per week in second ½ year.

Symbols (12 hours); compound numbers (20 hours); mono- and multinomials (46 hours); resolutions into factors (24 hours).

Geometry. 3 hours per week in first ½ year.
2 hours per week in second ½ year.

Introduction (12 hours); triangles (30 hours); parallel lines (28 hours); problems (10 hours).

Class 7

6 hours per week; 196 hours in all. (14 hours for revision of algebra and geometry; 18 hours for revision of arithmetic.)

Algebra. 4 hours per week in first ½ year.
3 hours per week in second ½ year.

Algebraic fractions (124 hours); proportions (6 hours); first degree equations of one unknown (30 hours); systematic study of first degree equations (18 hours); evolution of quadratic roots (12 hours).

Geometry. 2 hours per week in first ½ year.
3 hours per week in second ½ year.

Quadrilaterals (26 hours); circles (32 hours); inscribed and circumscribed circles (16 hours).

Class 8

6 hours per week: 196 hours in all. (16 hours for revision.)

Algebra. 4 hours per week in first ½ year.
3 hours per week in second ½ year.

Powers and roots (30 hours); quadratics and equations of higher powers (42 hours); systematic study of second degree equations with two unknowns (10 hours); functions and graphs (10 hours).

Geometry. 2 hours per week in first ½ year.
3 hours per week in second ½ year.

Similar figures (30 hours); trigonometrical functions (acute angles) 12 hours; metrical correlations in triangles and circles (20 hours); understanding of the applications of algebra to geometry (4 hours); areas of polygons (14 hours).

Class 9

6 hours per week (196 hours in all—12 hours for revision).

Algebra. 2 hours per week.

Progressions (14 hours); powers; concept of index of powers (8 hours); exponential functions and logarithms (36 hours).

Geometry. 2 hours per week in first ¾ year.
3 hours per week in last ¼ year.

Plane geometry; rectilinear polygons (12 hours); length of circumference and area of circle (15 hours); solid geometry (43 hours) involving straight lines only.

Trigonometry. 2 hours per week in first ¾ year.
1 hour per week in last ¼ year.

Definition of trigonometrical functions of angles from 0 to 360 (20 hours); radial measurements of arcs and angles (20 hours); general conception of angles; circular measure (20 hours); sine, cos, tan of positive and negative of any angle (24 hours); four-figure trigonometrical log tables (12 hours); solution of right-angled triangles with logs (12 hours).

CLASS 10

6 hours per week. 196 hours in all (20 hours for revision).

Algebra. 2 hours per week.

Combinations and binomial theorem (12 hours); complex numbers (12 hours); equations (22 hours); Bezut's theorem and its consequences (16 hours).

Geometry. 2 hours per week in first ½ year.
1 hour per week in second ½ year.

Polyhedrons (28 hours); circular bodies (20 hours).

Trigonometry. 2 hours per week in first ½ year.
3 hours per week in second ½ year.

Solution of obtuse-angled triangles (18 hours); inverse trigonometrical functions (14 hours); trigonometrical equations (18 hours); problems (16 hours).

APPENDIX 4 (*c*)

SYLLABUS OF MIDDLE SCHOOL CHEMISTRY, 1944

SUMMARY ONLY

CLASS 7 (81 hours per annum)

Substances and transformations (8 hours); H_2O (6 hours); O_2 and H_2 (8 hours); elements (1 hour); conservation of mass; air (6 hours); constancy of composition (4 hours); atomic and molecular weights (14 hours); oxidation and reduction (6 hours); oxides—elements—acids—salts (28 hours).

CLASS 8 (66 hours per annum)

Oxides—elements—acids—salts (14 hours); halogens (16 hours); sulphur (16 hours); N_2 and P_2 (20 hours).

CLASS 9 (82 hours per annum)

C and S (18 hours); periodic system and structure (16 hours); solutions, electrolytic dissociation, colloidal solutions (16 hours); general properties of metals (8 hours); alkalis and alkali-earth metals (8 hours); aluminium (6 hours); Fe (10 hours).

CLASS 10 (98 hours per annum)

I. Organic Chemistry (63 hours): Subjective organic chemistry (1 hour); laws of gases, molecular formulae (9 hours); hydrocarbons (16 hours); alcohols, phenols, ether (8 hours); aldehydes and ketones and acids (9 hours); compound ethers; fats (6 hours); carbohydrates (6 hours); organic substances with sulphur (8 hours).

II. Revision of Inorganic Chemistry course (31 hours).

III. Chemical War Substances (4 hours): Poison gases; smoke generators; defence against gases, etc.

APPENDIX 4 (*d*)

SYLLABUS OF MIDDLE SCHOOL PHYSICS AND ASTRONOMY, 1944

SUMMARY ONLY

CLASS 6 (66 hours per annum)

Introduction (1 hour).

Elementary mechanics: measurement of length, area, and volume (6 hours); gravity (4 hours); specific gravity (5 hours); force and its measurement (2 hours); pressure (6 hours); atmospheric pressure (7 hours); forces on bodies in liquids and gases (6 hours); mechanical movement (5 hours); friction (1 hour); energy and work (5 hours); simple mechanisms (6 hours).

Excursions (6 hours).

Revision (8 hours).

CLASS 7 (98 hours per annum)

Heat. Sources (1 hour); expansion (3 hours); transfer (4 hours); measurement of heat energy (8 hours); changes of state (5 hours); heat energy (3 hours); heat engines (5 hours).

Electricity. Current (5 hours); circuits (3 hours); amount and potential difference (3 hours); resistance (4 hours); Ohm's law (5 hours); energy and power (2 hours); heating effects of currents (3 hours); natural and artificial magnets (4 hours); electromagnetism (8 hours); electromagnetic induction (8 hours).

CLASS 8 (98 hours per annum)

Mechanics. Introduction (1 hour); kinetics and dynamics, rectilinear motion (12 hours); Newton's laws (18 hours); complexity of motion (8 hours); mechanical energy (8 hours).

Statics. Mutual neutralisation of forces (6 hours); centre of gravity (1 hour); moment of forces (3 hours); simple mechanisms (8 hours).

Hydro- and aerodynamics. Transfer of pressure by liquids and gases (4 hours); Archimedes' law (4 hours); atmospheric pressure (2 hours); motion of liquids in gases (6 hours).

CLASS 9 (82 hours per annum)

Mechanics. Rotary motion and oscillation (6 hours); laws of universal gravitation (3 hours); oscillations and wave motion (7 hours); sound (5 hours).

Heat and molecular physics. Heat energy (7 hours); thermal expansion (4 hours); molecular phenomena in gases, liquids, and solids (2 hours); properties of gases (9 hours); properties of liquids (5 hours); properties of solids (5 hours); fusion and hardening (4 hours); vaporisation (6 hours); humidity (3 hours); work done by gas and steam (8 hours).

CLASS 10 (132 hours per annum)

Electricity. Electric fields (12 hours); laws of currents (12 hours); magnetic fields (5 hours); currents in electrolytes (6 hours); currents in gases (5 hours); electromagnetic induction: generators, motors, and transformers (8 hours); electromagnetic oscillations and waves (10 hours).

Light. Sources of light, illumination (5 hours); speed of light (1 hour); light phenomena at interfaces (10 hours); spherical mirrors and lenses (12 hours); basis of wave theory of light (8 hours); dispersion and refraction (10 hours); distribution of light in uniform medium (2 hours); phenomena at surfaces (6 hours); resolution of white light (1 hour).

Excursions (4 hours).

Revision (10 hours).

In a preamble to the syllabus in physics it is emphasised that particular attention should be paid in all branches of physics to the solution of problems and to technical and military applications. In particular the following aims should be behind the teaching of physics to eighth, ninth, and tenth classes:—

(*a*) an exposition of the theory of physics necessary for a dialectical-materialist understanding of the world, in a form suitable for the pupils;

(*b*) the reinforcement and systematisation of a knowledge of physics necessary for its subsequent practical application;

(*c*) an explanation of the achievements of contemporary technology on a basis of physics.

In the tenth year (see Table I) there is a course of 33 hours of astronomy. The course includes a study of the solar system, stars, cosmogony, and observations in out-of-school hours. In Moscow there is a planetarium to which tenth-year pupils are taken.

APPENDIX 5

PASSAGES for translation from English to Russian, taken from *Uchebnik angliskovo yazika dlya sredney shkoly* (Textbook of the English language for middle schools), Part IV for eighth classes, by E. F. Bushtueva, Leningrad, 1938.

22. *Mister, Buy an Apple*

'Buy an apple mister. Only five cents apiece.' Hundreds of workers, young and old, unemployed for months and even years, stamping their cold feet against the pavement, coatless and shabby, shivering in the cold November day, are calling at the top of their lungs to every passer-by: 'Buy an apple, mister. Buy an apple.'

On the hats of the vendors there is a sign 'Unemployed'. Sure, that's it. Bosses, idlers, policemen, all are 'helping' the unemployed. Starving workers will be well provided for by buying, say, three dollars' worth of apples and after fourteen or fifteen hours of stamping on corners they will sell them for, say, four a and half dollars; they will thus make a whole dollar and a half profit. Anyhow it will keep the 'deserving' busy so that the 'reds will not get to them'.

A lady, an elegantly dressed lady, walks proudly down the street, notices a blue-faced vendor, stops and with a pitying smile takes out of her expensive bag a half bar of chocolate and offers it to the shivering apple vendor. The lady has done her 'good deed' and walks off, probably to a meeting of 'Be Kind to the Poor Animals'. There, perhaps, she will propose to organise a campaign for a bar of chocolate a day to keep the hungry workers from starving, and all her friends, the fine ladies and gentlemen of her society, will cheer her kindness.

The streets are crowded. Hurrying workers, well-fed business men, school-children, priests with smiles on their faces, pass these deserving workers as they shout: 'Buy an apple, only five cents. Mister, buy an apple.'

23. *Awakening in the Cotton Belt*

It was July. The cotton plant stood almost a foot high. Half-naked Negro men and boys were ploughing on the plantations. The sun was hot.

All is quiet on the domain, one may think. The Negroes are on the patches, the landowners in their mansions. We come within view of a three-room cabin. No shingles cover the roof. A sixty-five year old Negro cropper, his wife, seven children, and three grandchildren call this home. I have come there with Bill, the unemployed son of this Negro.

Everyone is astonished to see a white man in their cabin, because the appearance of a white man arouses suspicion in this country. Bill introduces me, saying, 'He is one of us.'

I extend my hand. The old man hesitatingly offers his toiler's hand; it is probably the first time in his life he has ever shaken hands with a white man.

'Have a seat, boss,' he says.

'He is not a boss, father. Among our people he is a comrade just like you and me,' explains Bill.

Bill is a new Negro worker. He takes part in the Communist movement and is no longer afraid of the white man, the 'boss', the 'master'. Old man Johnson, Bill's father, is a share-cropper. He farms twenty-five acres of land. By agreement with the landowner he is to turn over half of his cotton and corn for the use of the land. As he has neither plough nor mule he has to borrow them from a white landowner in return for ploughing his land. From the remaining half the landowner is to take his payment for the food he has advanced during the season. And for the winter? The part of the crop that is left is hardly enough to keep the family from starvation. All this I learn from the old Negro, while we are sitting in his cabin. A bell tinkles in the distance. 'They are off to work', mutters the old man. 'It is time for us to go. Twenty-five cents for chopping cotton—a full day's work. Isn't it awful?'

The same ideas are spreading all over the country. A new spirit pervades the Negro masses of the South. They begin to understand that it is necessary to struggle against the hard conditions of labour and that in this struggle the white revolutionary workers will support them and be in the leading cadres.

APPENDIX 6

SOME PARTICULARS OF SOVIET INSTITUTES OF HIGHER EDUCATION (FROM *Cpravochnik dlya postupaiushehikh v vischie uchebnie zavedenia S.S.S.R.*, 1945).

INSTITUTES of Higher Education are classified into the following categories.

Industrial and polytechnical institutes.
Machine construction and mechanical institutes.
Aviation institutes.
Power and electrotechnical institutes.
Mining, oil, and peat institutes.
Metallurgical institutes.
Chemical technology institutes.
Building and architectural institutes.
Institutes of the food industry.
Institutes of the meat and milk industry.

Institutes of the fish industry.
Institutes of the flour-milling industry.
Institutes of light industry.
Institutes of the cellulose and paper industry.
Printing institutes.
Institutes of the textile industry.
Forestry institutes.
Institutes of engineering economics.
Institutes of rail transport.
Institutes of water transport.
Automobile institutes.
Communication institutes.
Institutes of hydrometeorology and geodetics.
Agricultural institutes.
Institutes for the mechanisation of agriculture.
Irrigation institutes.
Veterinary institutes.
Forest economy and timber technology institutes.
Universities.
Institutes of international affairs.
Pedagogical institutes.
Library institutes.
Institutes of foreign languages.
Institutes of Oriental studies.
Medical, pharmaceutical, and dental institutes.
Institutes of planning and economics.
Institutes of Soviet trade.
Financial-economic institutes.
Banking-economic institutes.
Statistical-economic institutes.
Law institutes.
Institutes of cinephotography and cine-engineering.
Institutes of music, the theatre, and art.
Institutes of literature.
Higher correspondence departments.
Tutorial institutes.

APPENDIX 7

LIST OF UNIVERSITIES IN THE U.S.S.R.

Azerbaijan State University, Baku. Eight faculties and correspondence department.
Belorussian State University, Minsk. Six faculties and correspondence department.

Vilna State University (Lithuania). Six faculties (including medicine and forestry).

Voronezh State University, Voronezh. Six faculties and correspondence department.

Gorki State University, Gorki. Three faculties (physics, chemistry, biology) and correspondence department.

Dnepropetrovsk State University, Dnepropetrovsk. Seven faculties and correspondence department.

Erivan State University, Erivan. Nine faculties.

Irkutsk State University, Irkutsk. Five faculties and correspondence department.

Kazan State University, Kazan. Six faculties and correspondence department.

Kazakstan State University, Alma-Ata. Five faculties (one is journalism !) and correspondence department.

Karelian-Finnish State University, Petrozavodsk. Four faculties and correspondence department.

Kaunas State University, Kaunas. Four faculties.

Kiev State University, Kiev. Eleven faculties and correspondence department.

Latvian State University, Riga. Thirteen faculties (including engineering, medicine, architecture).

Leningrad State University (Order of Lenin), Leningrad. Twelve faculties: physics; maths-mechanics; chemistry; biology; geography; geology-soil-science; history; philology; philosophy; economics; law; Oriental studies; and correspondence department.

Lvov State University, Lvov. Eight faculties and correspondence department.

Molotov State University, Molotov. Five faculties and correspondence department.

Moscow State University (Order of Lenin), Moscow. Eleven faculties (see text) and correspondence department.

Odessa State University, Odessa. Six faculties and correspondence department.

Rostov State University, Rostov. Six faculties and correspondence department.

Saratov State University, Saratov. Seven faculties and correspondence department.

Ural State University, Sverdlovsk. Six faculties (including journalism) and correspondence department.

Middle Asia State University, Tashkent. Seven faculties (including oriental studies) and correspondence department.

Tartar State University, Tartru. Six faculties.

Tbilisi State University (Georgia), Tbilisi. Eight faculties and correspondence department.

Tomsk University, Tomsk. Six faculties and correspondence department (and special faculty).

Chernovitsi State University, Chernovitsi. Six faculties and correspondence department.
Uzbekistan State University, Samarkand. Four faculties and correspondence department.
Kharkov State University, Kharkov. Seven faculties and correspondence department.
And classified among universities:
Institute of Foreign Relations of Narkomindel. Two faculties: western and eastern.

APPENDIX 8

SYLLABUS OF A TYPICAL UNIVERSITY SUBJECT

PROGRAMME IN STATISTICAL PHYSICS.
(For physico-mathematical faculties in state universities.)

Introduction

THE history of the kinetic theory and the statistical method in physics during the nineteenth century, important occurrences in the development of this branch of physics: The atomic concept, reversibility and irreversibility of quantities, general characteristics of statistical methods and their rôle in present-day physics.

First Part. Statistical Theory of Equilibrium States
(Gibb's Method and its Application)

1. The formulation of the problem. Canonical distribution of small samples. Canonical distribution, similar to the distribution for a small portion of a system. The relation with thermodynamics. Statistical interpretation of thermodynamical functions. The equation of state and free energy, temperature.

2. The application of general rules to the ideal gas. The law of the Maxwellian distribution and its direct experimental verification (the distribution of thermoelectrons, Stern's experiments, etc.). The Bolzmann distribution. The van der Waal equation and the summation of interaction forces. The application of statistics to the theory of dielectrics, para- and dia-magnetism.

3. The theorem of the equipartition of energy among the degrees of freedom. Its application to theory of specific heat of gases and solids. The Virial theorem and similar theorems for quasi elastic systems. The defects of classical theory of specific heat. The equilibrium of radiation, Jeans' formula and its incompleteness.

4. The position of the question about the foundation of the basic rules of classical statistics. Liouville's theorem. The relation between the average over time and the average microcanonical.

Second Part. The Divergencies from Equilibrium States

1. The theory of fluctuations. The fluctuations in density of a gas. The Bolzmann principle and its application for solving problems concerning fluctuations. Molecularly scattered light and the critical opalescence in pure liquids and solutions.

2. The Brownian movement. The diffusion equilibrium. Einstein's formula for the coefficient of diffusion. The fluctuation of current in conductors. The degree of sensitivity of the instruments.

Third Part. The Application of Statistics to Irreversible Processes

1. Irreversible processes in gases. Elementary theories of heat conduction, viscosity and diffusion. Gases under low pressure. Temperature jump and slip. Radio-active effect. The 'basic' equation of the kinetic theory of gases. The Maxwell distribution as applied as a proof of the static case. The N-theorem and its meaning. The application of gas kinetic methods to electrons in metals. The elementary justification of the Widemann-Franz law. The Lorenz theory of metals.

2. Reversibility and irreversibility from the view-point of the kinetic theory. The question of the impossibility of the creation of perpetual motion of a secondary type. The statistical explanation of the second law of thermodynamics.

Fourth Part. Quantum Statistics

1. The basic rules of statistical theory in quantised systems. The average energy of an oscillator, and of a rotator. The theory of specific heat of polyatomic gases. Ortho- and para-hydrogen. The distribution of excited atoms. The theory of molecular dissociation.

2. The quantum theory of specific heat for solids. The natural frequencies of a solid viewed as continuous body and as a crystalline lattice. The Debye–Born theory of specific heat. The experimental confirmations of the Debye–Born model of thermal motion in solid bodies. Infra-red radiation from low-energy systems.

3. The application of quantum statistics to radiation. Planck's formula.

4. Pauli's principle. The Bose and Fermi statistics. The application of Bose's statistics to radiation. Fermi's theory of the degeneration of a gas. The difficulties which were cleared by the introduction of the Bose–Fermi statistics in the theory of metals. Pauli's theory of paramagnetism in alkali metals. Quantum statistics and the Nernst theorem.

Text-books

1. *Basic Text-books.*
    1. *The Theory of Heat*, Part II. K. L. Schäfer.
    2. *Statistical Physics, Lecture Notes.* Edited by A. M. Leontovich.
    3. *The Kinetic Theory of Matter.* A. K. Timirasov.
2. *Secondary Text-books.*
    1. *The Kinetic Theory of Matter.* Herzfeld.
    2. *Statistical Theory in Thermodynamics.* Lorenz.
    3. *Statistical Physics.* Landau and Livschitz.

An Atlas of the U.S.S.R.

By JAMES S. GREGORY, B.A., F.R.G.S.

and

J. F. HORRABIN

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The Atlas aims at giving the general reader, in condensed form, some up-to-date knowledge of the U.S.S.R. in relation to its geographical background. Mr. Gregory is the author of the U.S.S.R.; A GEOGRAPHICAL SURVEY, and the material for the Atlas has been gathered in the main from books published in Russia. It contains a great deal of matter not hitherto available in England. The maps and diagrams have all been drawn by J. F. Horrabin, whose name as a cartographer is a household word.

The subjects covered include graphs showing the distribution, density and growth of population; vegetation, soils and climatic zones; relief and chief surface features of the European and Asiatic areas of the U.S.S.R.; rivers, inland waterways and the internal water transport system developed by the Soviets; seaways and seaports; a series of maps and graphs showing the distribution and production of coal, oil, peat, timber, iron and other metals, wheat, sugar-beet, flax, cattle, etc.; maps illustrating the growth of agriculture and of industry since the revolution, and of railways and airlines. In short, the book gives the actual facts and figures about the extraordinary development of Soviet Russia which has enabled it to defeat the organised power of Nazi Germany, and about which there was not only widespread ignorance but almost complete misunderstanding before 1941.

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